Computer Program and User Documentation Medical Data Tape Retrieval System

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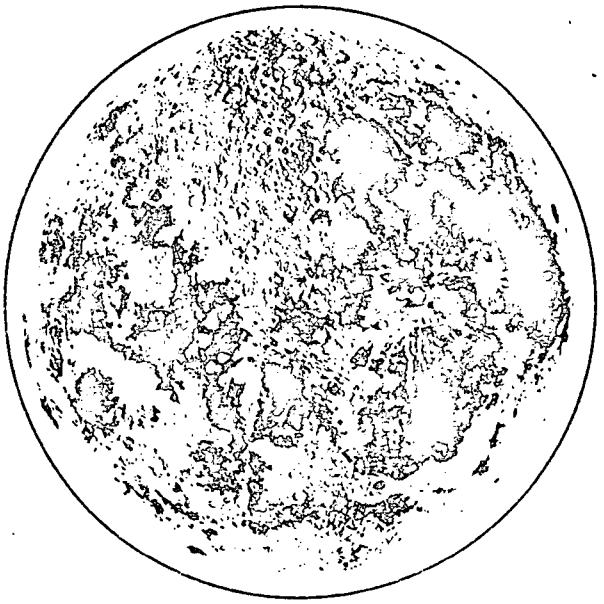
NAS9-11579



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COMPUTER PROGRAM AND USER DOCUMENTATION

MEDICAL DATA TAPE RETRIEVAL SYSTEM

Contract NAS 9-11579

Submitted to the

BIOMEDICAL DATA SYSTEMS OFFICE

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER
INFORMATION SYSTEMS BRANCH
Houston, Texas

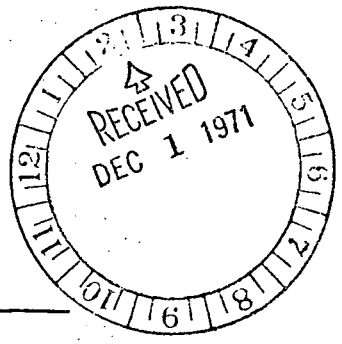

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TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

LIST OF FIGURES

1.0 SCOPE

The purpose of this volume is to provide the reader with several levels of documentation for this program module of the NASA Medical Directorate Mini-computer Storage and Retrieval System.

The Biomedical Information System Overview (Section 2) describes some of the reasons for the development of the mini-computer storage and retrieval system. It briefly describes all of the program modules which constitute the system.

The General Specifications Section (Paragraph 3.1) describes the purpose and function of the specific program module documented in this volume.

The Technical Specifications (Paragraph 3.2) is oriented to the programmer. It is a technical discussion of the same processing described in general terms in the previous section, but is a high enough level as not to be redundant with the very detailed analysis described in the Subroutine Section 3.3.

The Subroutine Section (Paragraph 3.3) describes each subroutine in enough detail to permit an in-depth understanding of the routines and facilitate program modifications.

The Program Utilization Section (Paragraph 4.0) may be used as a "Users Guide" and is as non-technical as possible.

To eliminate unnecessary reproduction, the program listings are maintained in a separate document which may be obtained from the VARIAN library of computer programs currently maintained in Building 32 at NASA MSC. In addition, another document is to be developed for the Medical Directorate management. The document will describe the mini-computer system on a higher functional level and will illustrate how the mini-computer storage and retrieval system interfaces with the total directorate data management plan.

2.0 BIOMEDICAL INFORMATION SYSTEM OVERVIEW

For several years, the NASA Medical Directorate has been developing a Medical Information Management System (MEDATA). The System, as implemented at NASA, utilized an off-line IBM 1050 for preparation of data input via paper tape and required card deck runs for retrieval of data from the data files. A new phase of development has been implemented utilizing remote terminals and mini-computers. This section describes the development rationale of the remote terminal and mini-computer approach.

Several features of the old MEDATA system presented serious difficulties to the system user and made the system unresponsive. These deficiencies in the system included:

- Input data prepared on punched paper tape
- No online data input capability with the data base (i.e., no remote data entry)
- Data corrections via punched paper tape
- Preparation of retrieval requests via a punched card system
- 48-hour turnaround time required for retrieval outputs.

To improve the overall responsiveness of the system and eliminate these deficiencies, Philco-Ford developed the Varian/MEDATA Storage and Retrieval System (VMSARS) which utilizes the Varian 620I computer systems in Building 32 or 37.

VMSARS consists of the Medical Data Input System (MDIS), the Medical Data Update System (MDUS), and the Medical Data Tape Retrieval System (MDTRS). The Medical Data Input System (MDIS) is used to input data via a CRT. If updates or reviews are desired, the output of MDIS may be updated on the CRT by the Medical Data Update System (MDUS). The data tape (MDIS or MDUS output) is entered into the CAAD MEDATA system where it is sorted and merged into the appropriate Medical Data File. The updated CAAD MEDATA Medical Data Tape File is sent back to the Varian computer system and used as input for the Medical Data Tape Retrieval System (MDTRS) which processes data retrieval requests from remote terminals. The primary advantages of the VMSARS are as follows:

- Use of state-of-the-art input devices such as CRT's and portable acoustic-coupled teleprocessing terminals. (CRT's operate at 2400 bits per second on the telephone lines.)

- Elimination of paper tapes from the system. (Data storage is on magnetic tape.)

- Online data input from remote input station via the telephone lines.

- Error correction capabilities on CRT. (Limited error checking is performed by the computer.)

- Update capabilities on Varian system before data is entered into the CAAD MEDATA system.

- Ease of creation and updating of background forms.

- Capability of transmitting MEDATA retrievals over telephone lines to CRT or TTY.

- Capability of performing online retrievals.

VMSARS was used for the Flight Crew Health Stabilization Program for three months preceding the launch of Apollo 14 and Apollo 15. A Computer Communications Inc. (CCI) CRT and keyboard and an Execuport Typewriter were installed in the surveillance command post at KSC, and a surveillance master file was created. The VMSARS was used to collect data, perform updates, and retrieve data from the surveillance master file.

The overall system, including the CAAD MEDATA system interface, is illustrated in Figure 2-1. The individual programs are described as follows:

MEDICAL DATA INPUT SYSTEM

The Medical Data Input System (MDIS) is designed to collect data from a CRT input station and store the data on a magnetic tape. The medical questionnaire forms are maintained on magnetic tape and are read into computer memory at run time. The user selects the appropriate form to be displayed on the CRT. As each form is completed, the data is stored on magnetic tape. This tape may be further updated, transmitted to another terminal, or input to the 1108 MEDATA system. Hardcopies of any form are produced at the

user's request. The system requires only one tape unit and operates either via the phone lines or directly online with the computer.

MEDICAL DATA UPDATE SYSTEM

The Medical Data Update System (MDUS) updates any tape created by MDIS. Two tape-drives, a CRT, and printer are required. The old data is read from the MDIS output tape and displayed on the CRT. Changes may be made to the data on the CRT; comments or recommendations may be added to the record, and the new updated record written to the update tape. The updated tape may be either transmitted to another terminal or input to the MEDATA system, or both. Hardcopies of the records are produced if requested by the user. Refer to Figure 2-3 for an illustration of the MDUS components.

MEDICAL DATA TAPE RETRIEVAL SYSTEM (MDTRS)

MDTRS permits the user to make data retrievals from the MEDATA master tapes created by the 1108 MEDATA system. The 1108 system builds the MEDATA master tape from several sources, one of which is the MDIS or MDUS created input tapes. MDTRS outputs preprogrammed retrieval questions from the Varian computer to the requester's CRT or typewriter. The user builds his retrieval request by answering these questions. When the retrieval request is complete, MDTRS searches the MEDATA master tape for the data, formats the selected data for output, and outputs the data to the terminal. The CRT may operate on a private telephone line at 2000 bits per second and the typewriter operates on any commercial telephone line at 300 bits per second. Refer to Figure 2-4 for an illustration of MDTRS components.

2.1 OVERVIEW SUMMARY

In summary, the Varian/MEDATA Storage and Retrieval System provides the user with an online input and retrieval capability previously unavailable. The response time is significantly improved over the old paper tape system. There are still two weak points in the system due to hardware constraints. These are (1) the requirement to update the MEDATA master file on the CAAD 1108 computer system, and (2) the use of tape instead of disk for storage of the data base. A more comprehensive storage and retrieval system is being designed to operate on a Varian 620 mini-computer system utilizing a disk memory storage device and an input/output multiplexing device. The new system will permit immediate update of files, faster response for retrieval requests and multiple terminal users operating simultaneously.

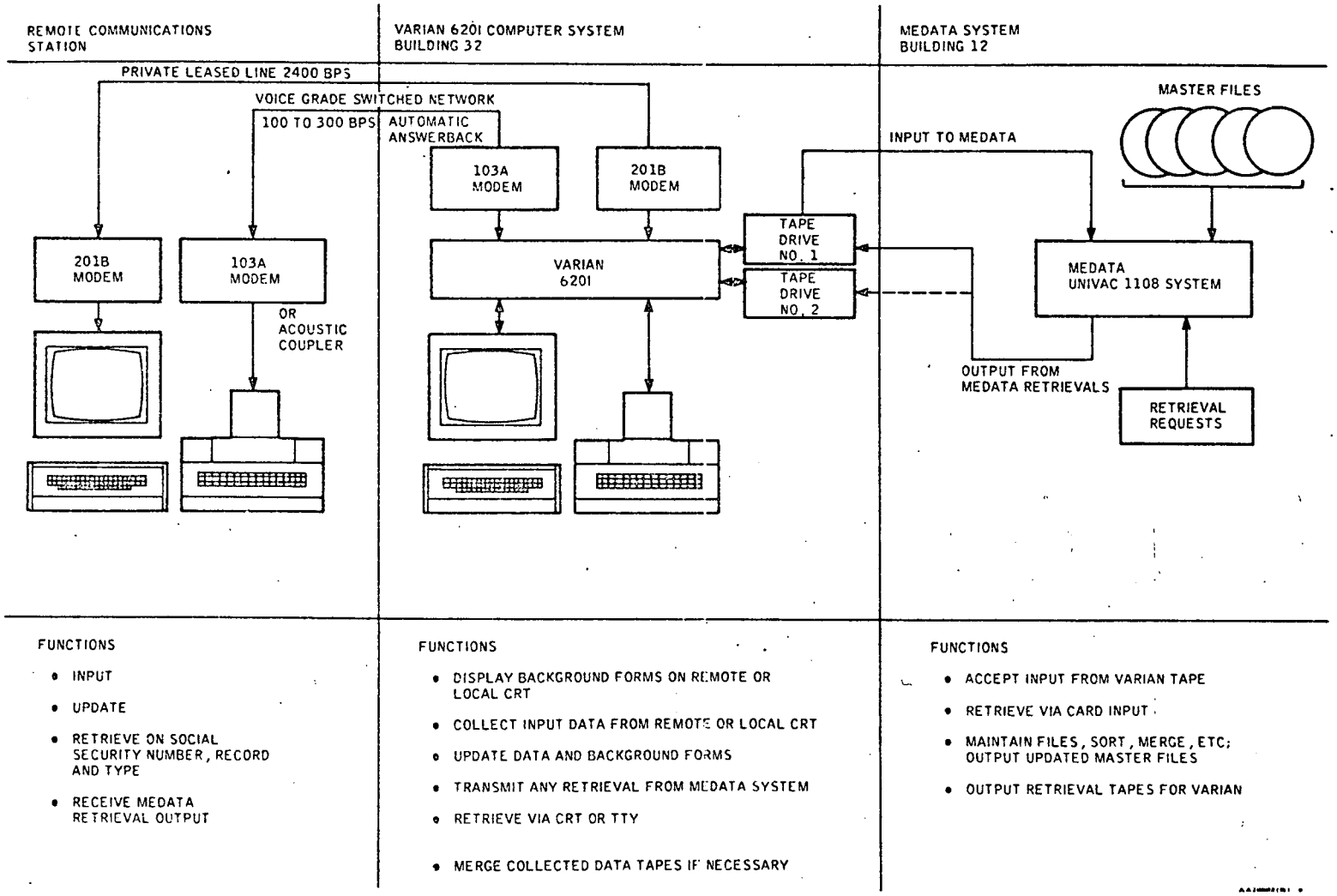


Figure 2-1 Varian/MEDATA Storage and Retrieval System

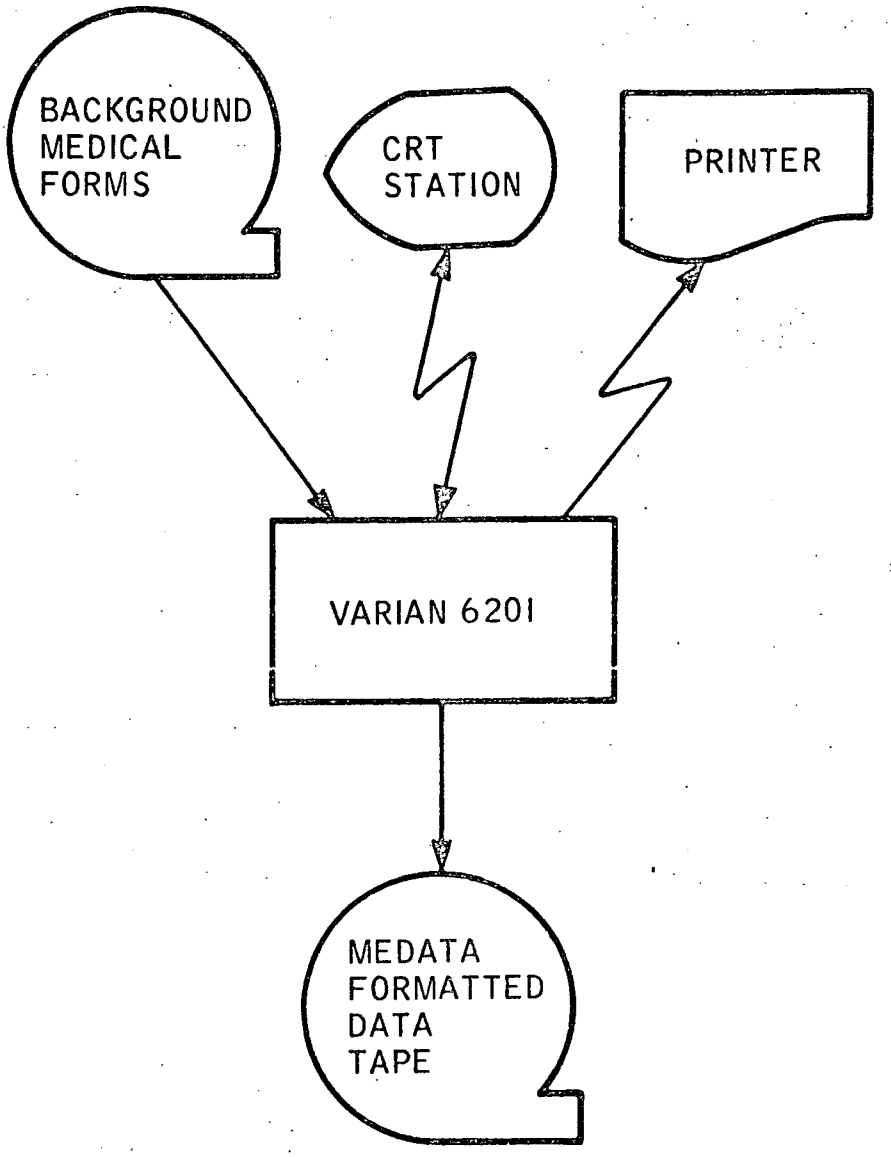


Figure 2-2 Medical Data Input System

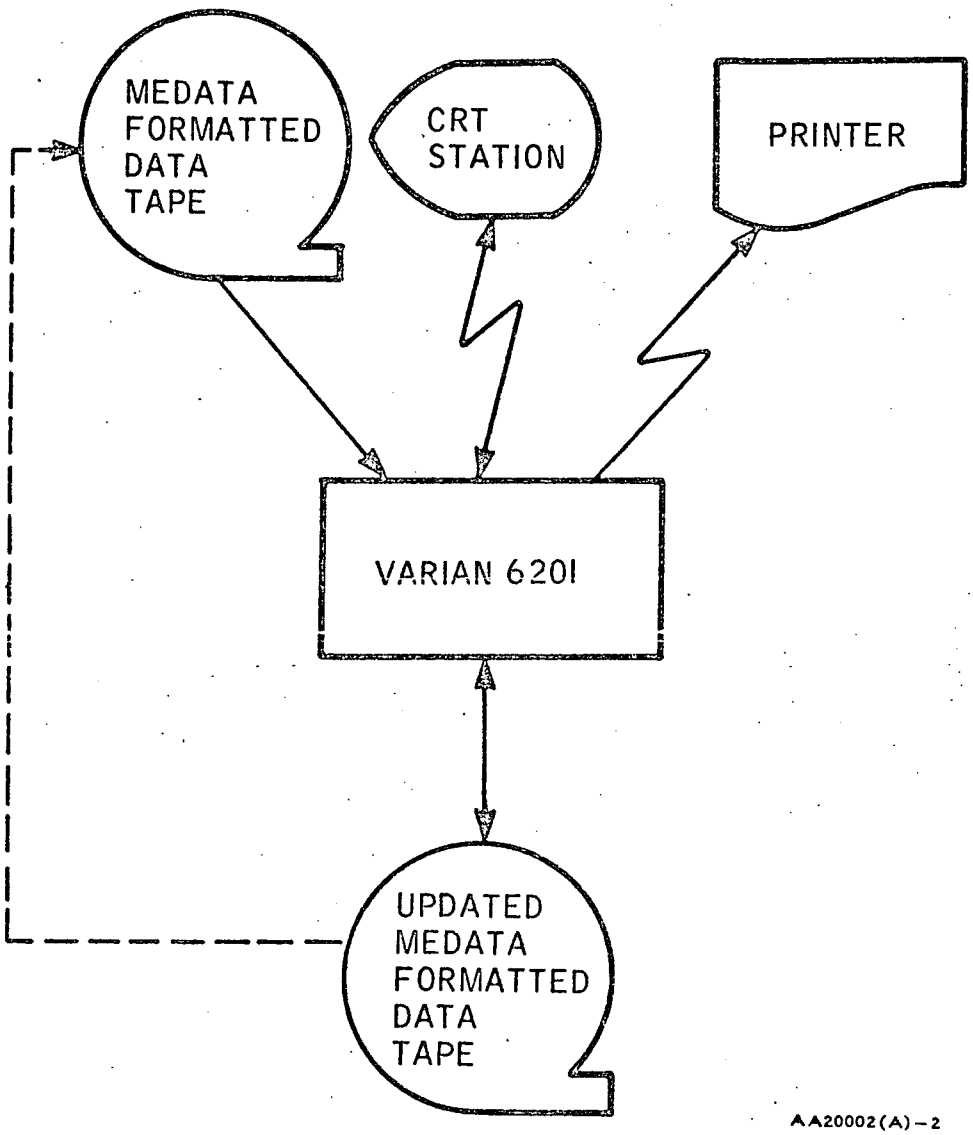


Figure 2-3 Medical Data Update System

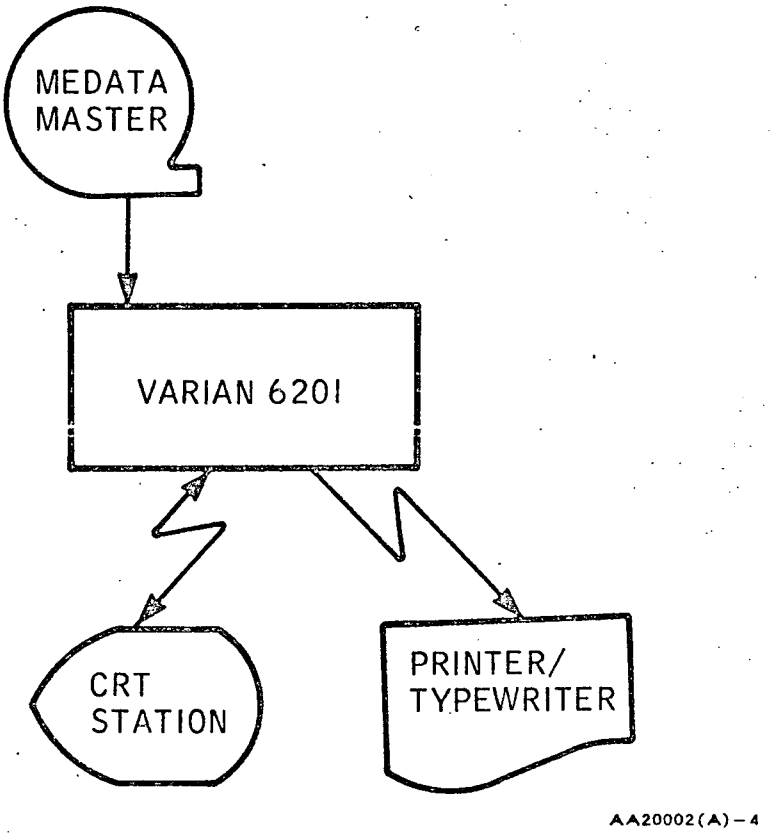


Figure 2-4 Medical Data Tape Retrieval System (MDTRS)

This document describes in detail one of the three components of VMSARS, the Medical Data Tape Retrieval System (MDTRS).

3.0 MDTRS SYSTEM

3.1 GENERAL SPECIFICATIONS

3.1.1 Background

After the input system (MDIS) and the update system (MDUS) were implemented in the latter part of 1970 at the Manned Spacecraft Center, it became apparent that a retrieval system on the Varian 620I computer would be a worthwhile complement to the overall storage and retrieval operations at MSC. At the time, all retrievals were done in a batch processing environment which did not lend itself to the near-real-time requirements of certain individuals in the Medical Directorate. Once they had identified the types of information they required from the data base, these scientists and doctors were not at all satisfied with the twenty-four hour delay that was necessary before they could receive their data. Thus, at the start of 1971, work began on the Medical Data Tape Retrieval System (MDTRS) which was modeled after the system used in the batch processing environment. The principle difference was to be in the use of a computer dedicated to retrieving data from a master file, and operated either locally at the computer or from a remote station over an ordinary telephone line. On July 1, 1970, it was implemented.

The MDTRS permits a user to retrieve specific information from his data base. What information is selected, and the format in which it is output, is determined by the request the user submits via a keyboard connected to the computer. There are a number of different types of outputs the user may specify, as well as a limited amount of statistical information on the data.

3.1.1 Background (Continued)

During the twenty-one day preflight quarantine of Apollo 15, the MDTRS got its first real test in the Flight Crew Health Stabilization Program. In order to minimize the possibility of any prime crew member contacting a disease, all persons coming in contact with the crew during this quarantine period were put under medical surveillance. Personal and family medical information was collected on each individual. This information was available for retrieval via the MDTRS as any need arose. Rapid access to the data base and the statistics the retrieval system provides were the key components of the surveillance program which is planned for use in all remaining Apollo missions.

3.1.2 Functions of the System

In order to understand any further discussion concerning the MDTRS, several terms should first be defined.

operator - the individual who loads the computer with the programs necessary for operation of the MDTRS

user - the individual who wishes to retrieve data, and will operate the local or remote station that controls the MDTRS

request - a set of seven questions and answers completed by the user at his station, which direct the MDTRS in its operation

response (request response) - answers to the seven questions of the request; keyed in by the user at his station

retrieval - all inputs, outputs, and processing necessary to fulfill all phases of a user-input request

3.1.2.1 Input

Input to the MDTRS is of two types:

(1) keyboard manual data entries, and

(2) magnetic tape master file data input.

Keyboard entries are made both by the operator and the user. Operator entries define the computer location and the user input device. User inputs are in the form of request responses. All processing is done on these inputs or the data tape inputs described in detail in Appendix A.

3.1.2.2 Processing

A request specifies three things: (1) identification of the record or records to be dealt with, (2) what portion of that record to be output, and (3) what format to be used for output. Once this request has been input and validated, the data tape is searched for the record identified. The specified output is then begun. Processing continues until all requested data has been output, or until the user aborts the retrieval.

3.1.2.3 Output

Two types of output, magnetic tape or printed pages, are available with the MDTRS. Tape output is used to make a duplicate of portions of the master file. This may be helpful when many retrievals are to be done using the same small portion of the data over and over again. The printed output applies to all or a portion of a record and may be in several formats.

3.2 TECHNICAL SPECIFICATIONS

3.2.1 System Description

The MDTRS can be divided into four functional modules: Initialization, Request, Record Match, and Output. Each module plays a critical role in the successful operation of all succeeding modules.

C O N T R O L	INITIALIZATION	I/O Device Selection
	REQUEST	Retrieval Definition
	RECORD MATCH	Record Selection
	OUTPUT	Data Formatting and Output

3.2.2 Input

There are three types of input data used in the MDTRS: operator initialization data, user request data, and master tape date. The first type is used during Initialization when three questions concerning the computer configuration are answered via the system input device, the teletype. These three answers tell (1) on what computer configuration the system is running, (2) what device is to be used for user input and output, and (3) on what unit (10 or 11) the Master File is mounted.

After Initialization the MDTRS is ready to accept the user's inputs. These inputs define the retrieval to be performed, and make up the data input for

the Request module. There are seven questions that must be answered and they are:

- SS NO:
- RECORD:
- TYPE:
- DATE
- CONDITION:
- ACTION:
- WHAT:

The first five questions identify a specific record from the master; the last question defines what portion of that record is to be output; and the sixth question specifies the output format. There exist strict rules for the input of request data. These rules are stated in Section 4 of this document.

Appendix A details the exact layout of the Master File and the records on the file.

3.2.3 Processing

Initialization

The first thing done after the system is loaded into the computer is the initialization of all I/O handlers based on the computer configuration and the location of the user terminal. This initialization includes inserting the correct device codes into the input/output instructions and inserting any other device-dependent coding necessary for proper interface with all peripheral devices. All routines using the I/O handlers are to assume that the primary input and output device is a teletype. The appropriate handlers will take the necessary action with special characters.

Request

In the Request module, the seven questions of the Retrieval Request are processed separately. In each case, there is a limited amount of erro checking. This is done to prevent a retrieval from being rendered useless after several minutes of processing, due to some error in the format of a user's inputs which makes it impossible to determine what he actually wants. Each question is checked for a blank response. In this event there is one, the default response can be assumed for each question. These default responses are:

- SS NO: ALL
- RECORD: ALL
- TYPE: ALL
- DATE: ALL
- CONDITION: NONE
- ACTION: LIST
- WHAT: ALL

As a Request Response is processed, it is placed in a buffer called the Request Buffer (CPRB). In the Request Table (CPRT), the beginning location of each response is saved and used later by the Record Match and the Output modules.

Record Match

Once all responses have been successfully input, the tape is searched for a record that matches the selection criteria (the first five questions) of the Request. The processing in the Record Match module is relatively simple for

the first four questions. These make up the ID section of the record (see Appendix A). In most cases a straight comparison can be made between the Request Response in the Request Buffer and a fixed area of the Tape Input Buffer. If the two are exact, the match is true. However, the response to CONDITION may have Boolean operators, which allow the user to specify complex conditions. These responses are made up of Headings and Answers from the Body Section of a record. In the Request module, the response to CONDITION was placed in the Request Buffer, and a tree network was created to facilitate easy and rapid determination of the logical conclusion of the Boolean expression in this response. The Headings and Answers make up the base of the tree. In the Record Match module, as each Heading-Answer pair is matched, a flag is set that allows the program to proceed further up the tree from the base. Once the top of the tree is reached, the Boolean expression is true. If the expression is true, the record is said to match the CONDITION response.

Output

A record is selected when the first five questions of the selection criteria of the Request are fulfilled. The sixth question specifies the format of the output. The appropriate routine is called and collects the data specified by the response to the WHAT question. As soon as enough data for one line of output is collected, the Output Message routine (OM00) is called. This routine selects the necessary output handler, based on the operator input data of the Initialization module. When all the requested data on the record is processed, control is again passed to rhe Record Match module which searches

for another record to match the selection criteria of the Request.

End Action

Three things will terminate the retrieval processing:

(1) the SS NO on record exceeds the one specified in the Request;

(2) the end of the tape data (end-of-file) is reached; and

(3) the user elects to abort the retrieval from his remote station.

Each Output subroutine in the Output module has some specific action that must be performed in the event one of the above events occurs. Once this action is completed, control is transferred to the Request module and the processing begins again.

3.2.4 Output

There are three types of output in the MDTRS: user I/O device output, system I/O device output, and user-requested tape output. The three types will fall into one of three categories:

(1) user-requested output may go to either tape or the user I/O device;

(2) error messages may go to the system or user I/O devices;

(3) advisory messages may go to the user I/O device during retrievals, or to the system I/O device during initialization.

The user I/O device may be any one of the following:

(1) CLINC Teletype #1

(2) CLINC Teletype #2

(3) DOC Teletype

(4) 103A Modem

The system I/O device is the Teletype in all cases.

Examples of user-requested output may be found in Appendix J. These outputs are in one of four ACTION formats:

(1) LIST

(2) COUNT

(3) COPY

(4) TABULATE/ANALYZE.

3.2.5 Buffers and Tables

The function of the Request module is to accept the user's inputs, save the responses in the Request Buffer (CPRB), and organize a set of buffers and tables that will be used in the remaining two modules of the MDTRS. To completely comprehend the processing done in the last two modules, these buffers and tables, and their interrelationships must be fully understood. Appendices B through G define the layout of each of the specific buffers of concern in the Request module.

Request Buffer and Table

In Figure 3-1, there is a diagram showing the relationship between the Request Table and the Request Buffer. All Request responses are placed in the Request Buffer, with the starting addresses of the first four saved in the Request Table. Should any Request question not have a response, a zero is placed in the position of the Request Table associated with that response. This zero indicates the Default Condition for that question.

Operand Buffer - simple response

For the response to CONDITION, one of two situations may exist: a complex response with Boolean operators or a simple response without Boolean operators.

Figure 3-2 is a buffer diagram for the simple response. In this example, the first location in the Operand Buffer contains the beginning location of the CONDITION response. The second location contains a -1 to indicate that there are no more parameters in the response.

Condition Table

Each simple response may be one of four forms:

(1) Heading only - flag = 0;

(2) Heading plus alpha Answer - flag = 1;

(3) Heading plus numeric Answer - flag = 2;

(4) Heading plus range of numeric Answer - flag = 3.

To signify which form each simple response may be, a table (Condition Table) has been created containing a flag to signify the form of the response, and a pointer to locate the answer associated with each simple response. In the sample in Figure 3-2, the flag is two, indicating a Heading with a numeric Answer. The pointer is next in the table and locates the Answer in the Request Buffer.

Bool Buffer and Operand Buffer - complex response

A complex response is a series of simple responses separated by the Boolean operators AND and OR, and possibly grouped using parentheses as required. Figure 3-3 is an example of the buffer arrangement associated with a complex response. The Operand Buffer is now a series of two word sets - the first word of the set contains a pointer to the Heading portion of the simple response in the Request Buffer; the second word contains a pointer to the Boolean operator associated with that simple response. Every simple response of the Operand Buffer is linked to an operator. This operator is located in the Bool

Buffer and may link to other operators in the Bool Buffer depending on the degree of complexity of the CONDITION response.

What Table

The responses to the question WHAT are handled in exactly the same manner as the CONDITION responses, with the exception that the What Table is used in place of the Condition Table.

The ACTION response results in a flag being set in the sixth location of the Request Table. For a list of these flags and their meanings see Appendix B.

SS NO: 123-45-6789*
RECORD: REPORT*
TYPE: MEDICAL BACKGROUND*
DATE: 07MAY71*
CONDITION: *
ACTION: *
WHAT: *

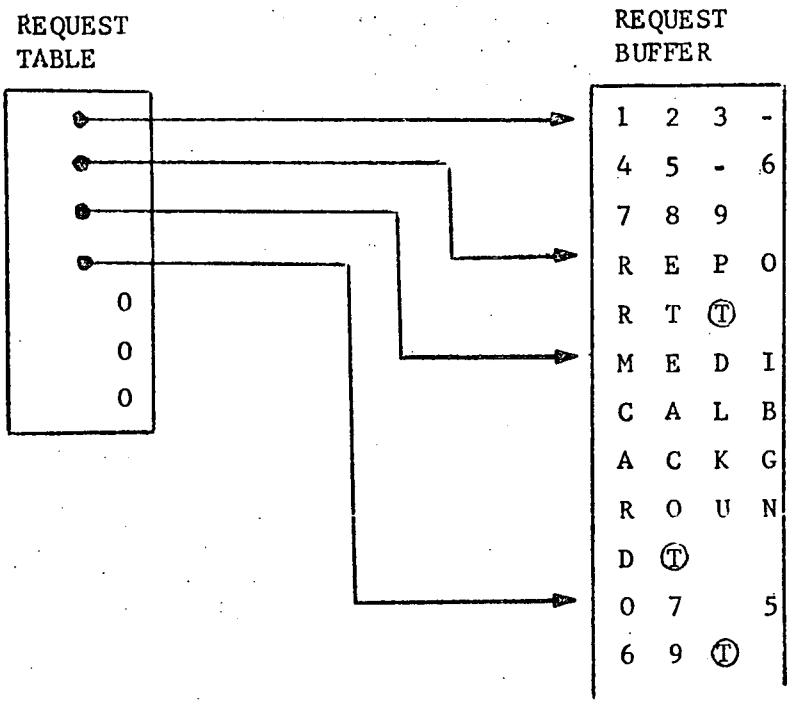


FIGURE 3-1 BUFFER DIAGRAM FOR SS NO, RECORD, TYPE, AND DATE RESPONSES

```
SS NO: *
RECORD: *
TYPE: *
DATE: *
CONDITION: TEMP:100*
ACTION: *
WHAT: *
```

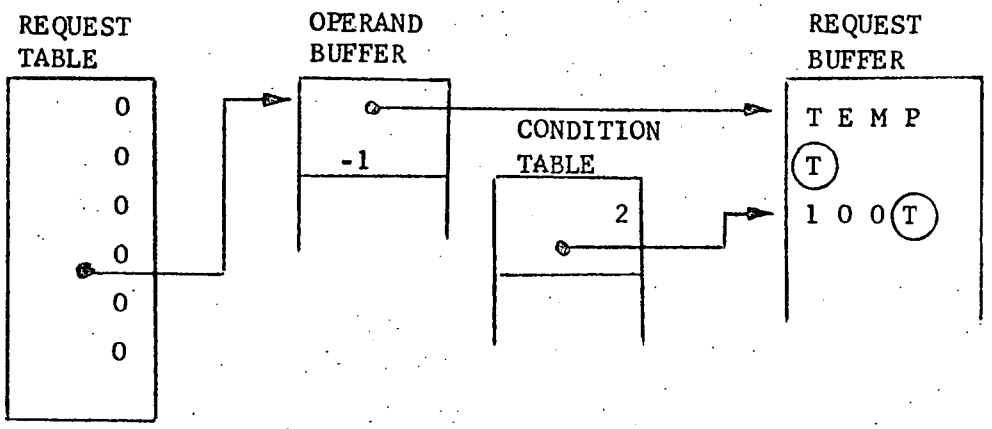


FIGURE 3-2 BUFFER DIAGRAM FOR SIMPLE CONDITION RESPONSE

```
SS NO: *
RECORD: *
TYPE: *
DATE: *
CONDITION: TEMP:100 AND HIGH BP:POS*
ACTION: *
WHAT: *
```

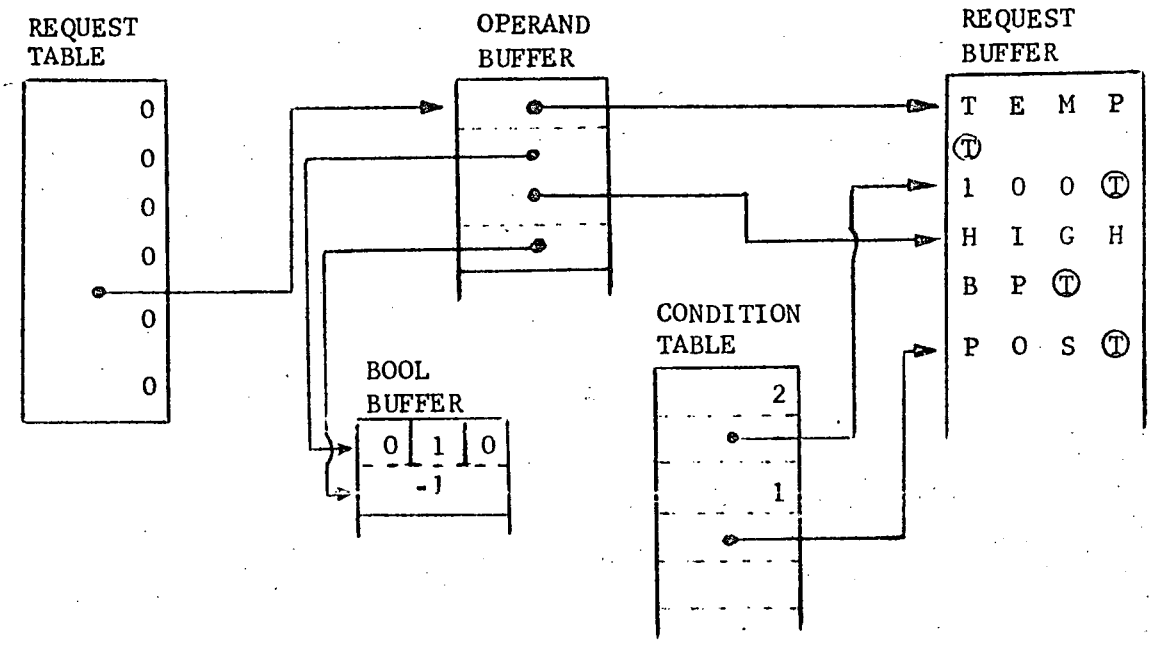
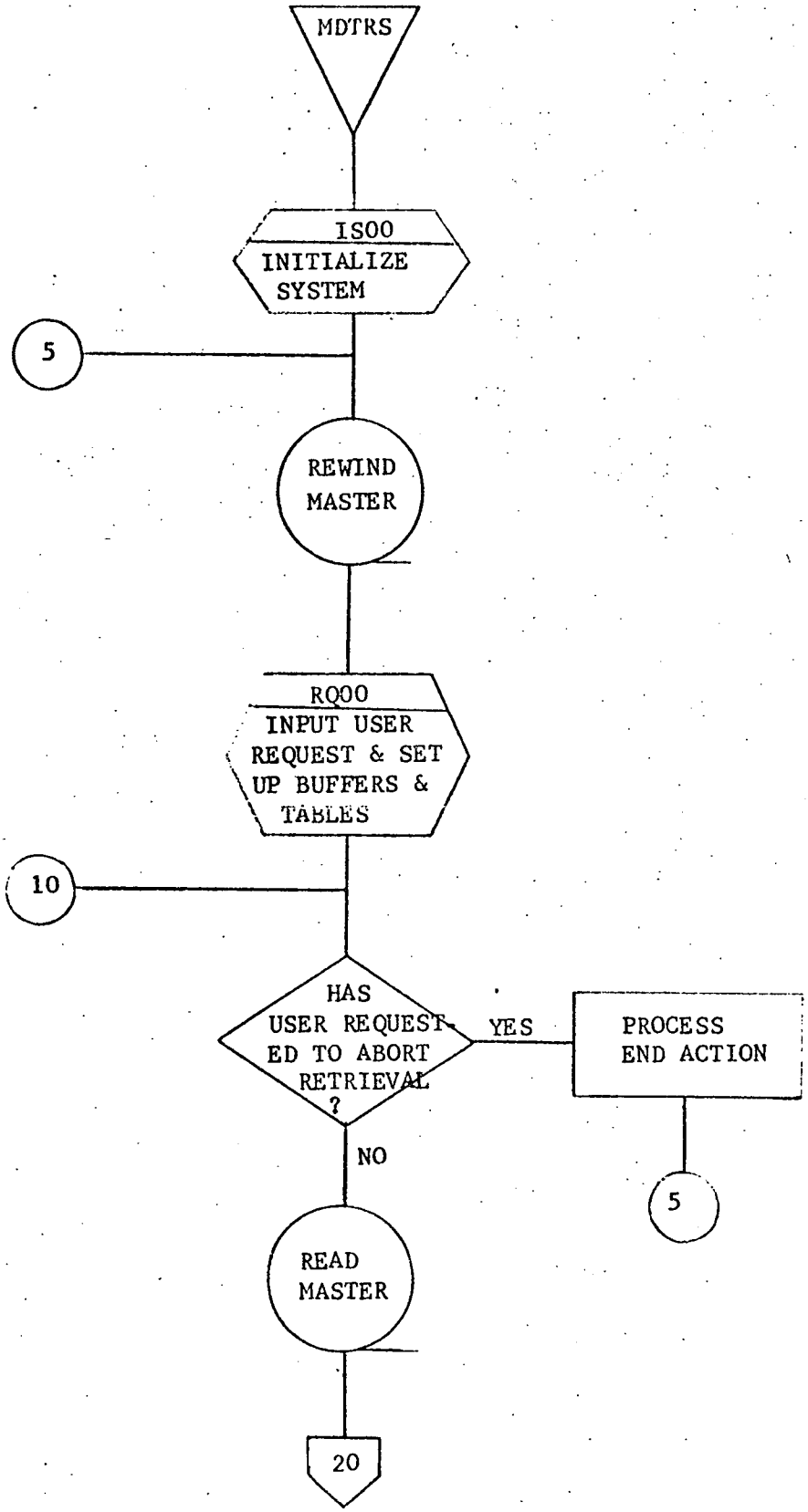
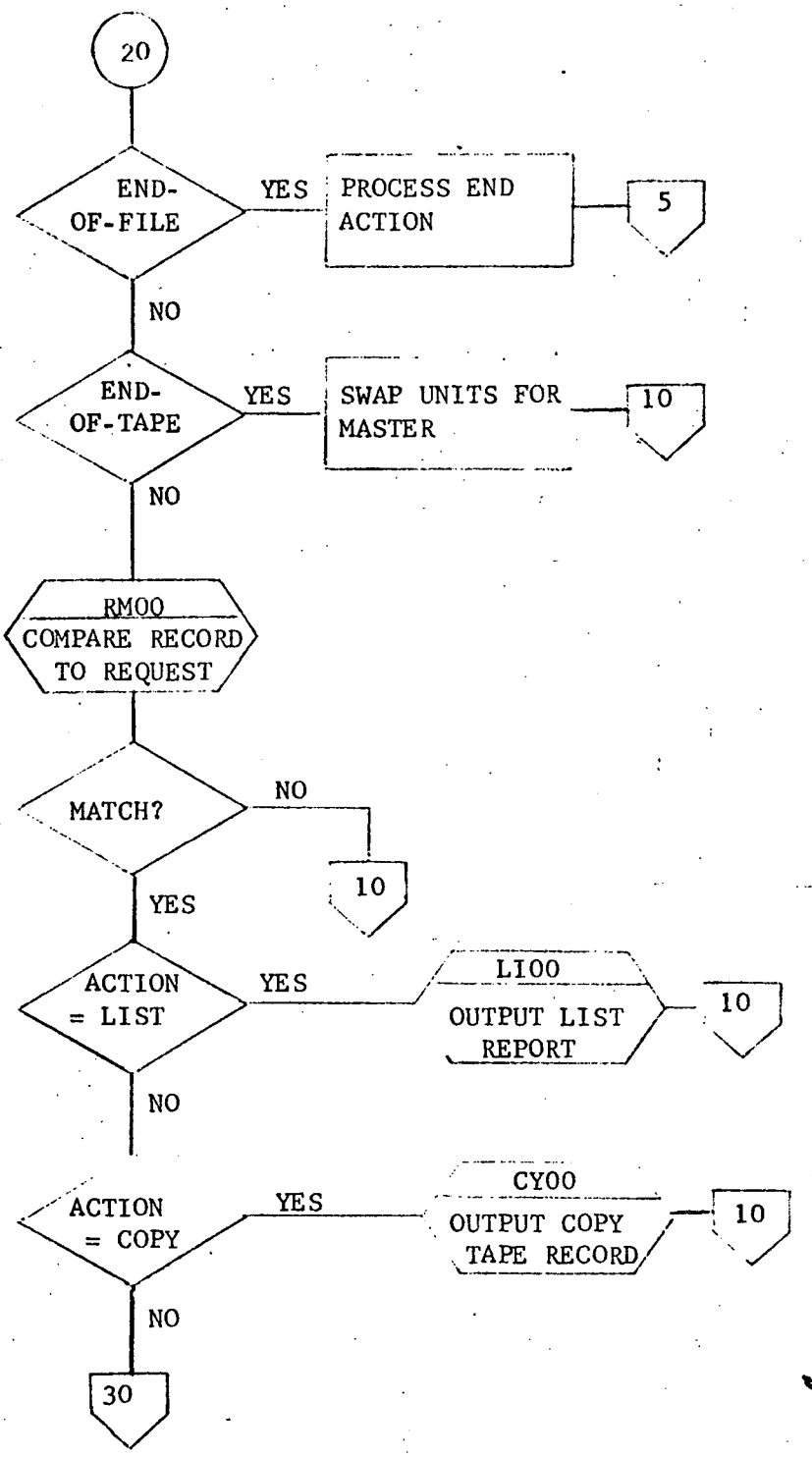
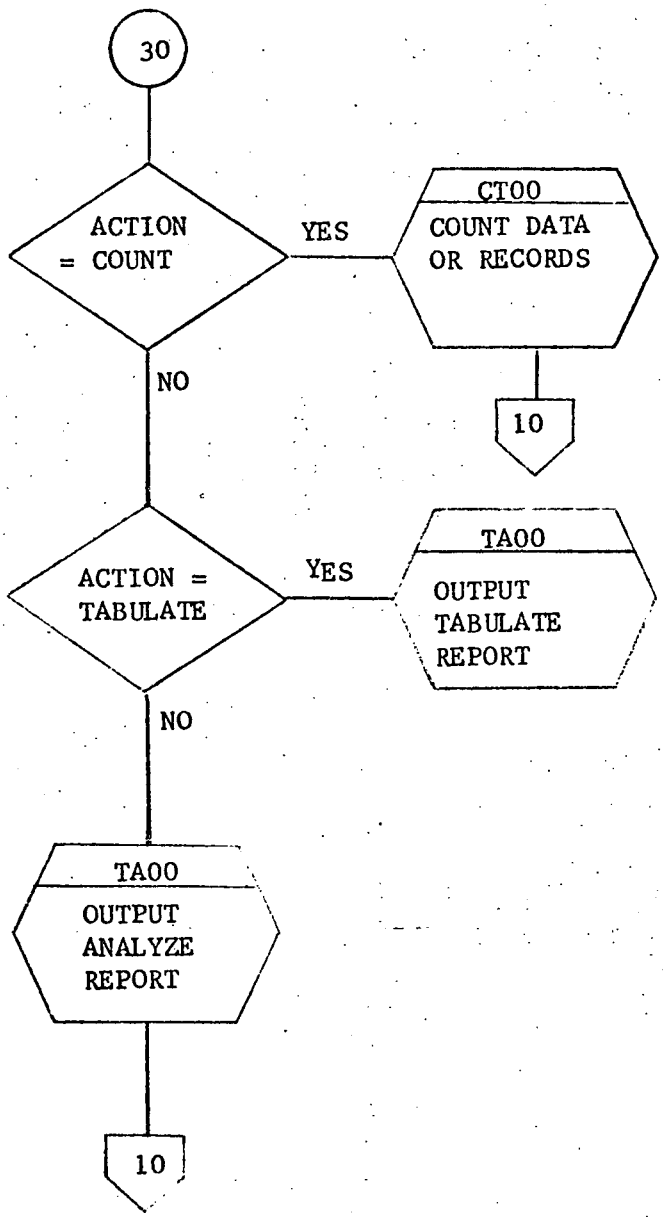


FIGURE 3-3 BUFFER DIAGRAM FOR COMPLEX CONDITION RESPONSE

3.2.6 System Flow




20
END-
OF-FILE
YES
PROCESS END
ACTION
5
NO
END-
OF-TAPE
YES
SWAP UNITS FOR
MASTER
10
NO
RM00
COMPARE RECORD
TO REQUEST
MATCH?
NO
10
YES
ACTION
= LIST
YES
LI00
OUTPUT LIST
REPORT
10
NO
ACTION
= COPY
YES
CY00
OUTPUT COPY
TAPE RECORD
10
NO
30


30
ACTION
= COUNT
YES
CT00
COUNT DATA
OR RECORDS
10
NO
ACTION =
TABULATE
YES
TA00
OUTPUT
TABULATE
REPORT
NO
TA00
OUTPUT
ANALYZE
REPORT
10

3.2.7 Hardware Configuration

Following is a minimum hardware configuration for operation of the MDUS;

1 - Varian 620/i computer with 20K of core memory

2 - tape drives

1 - teletype

3 - Buffer Interlace Controllers (BIC)

1 - Priority Interrupt Module with the following interrupts.

End of Transmission interrupts on all BIC's

CRT keyboard interrupt

1 - 103A Modem

The two tape drives should be connected to separate BIC's.

3.2.8 System Block Diagram

See Figure 3-4.

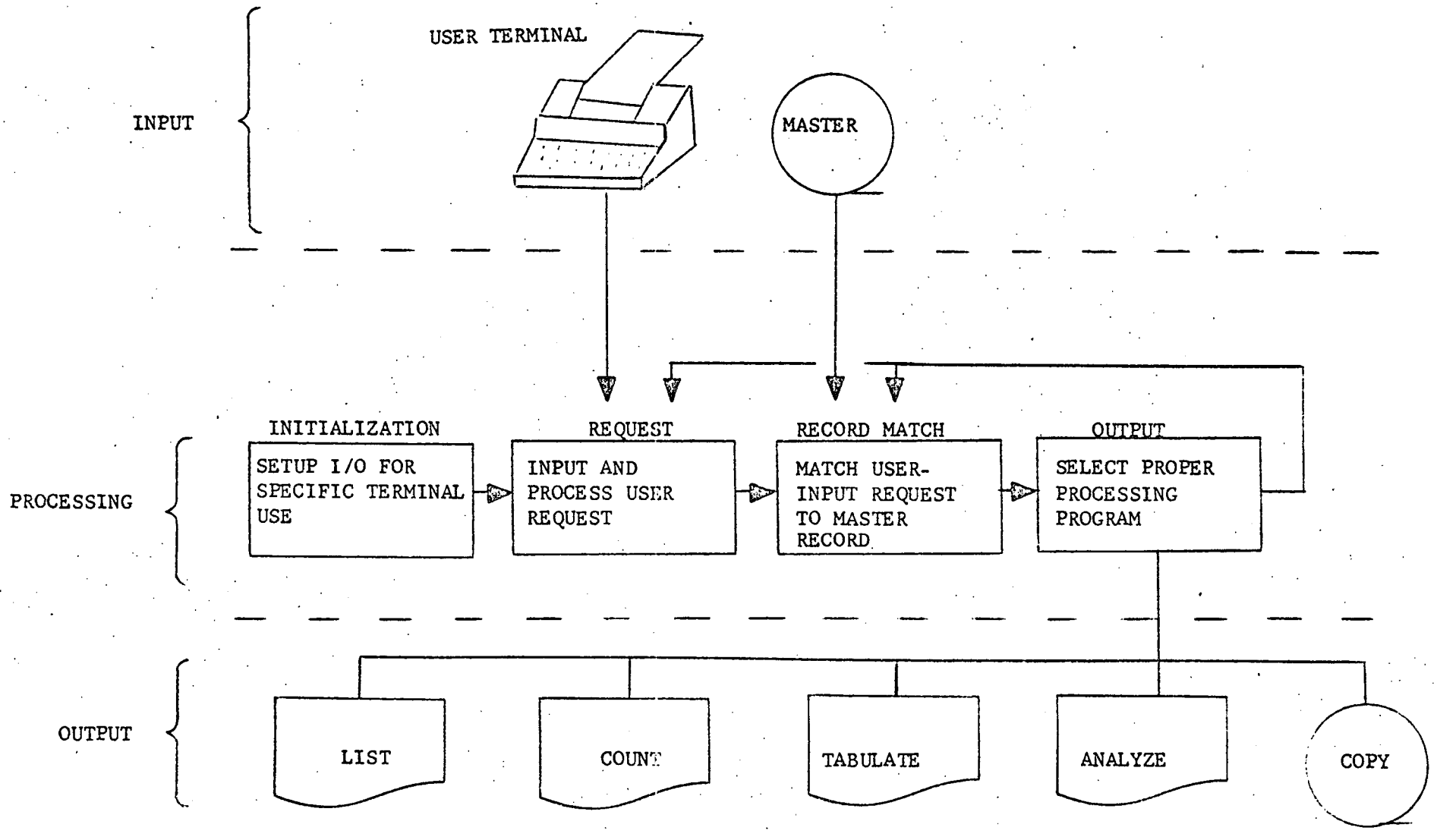


FIGURE 3-4 MDTRS SYSTEM BLOCK DIAGRAM

3.3.1 BLOO - Setup Boolean Tree

3.3.1.1 Purpose

The purpose of the subroutine is to set up a tree network for CONDITION and WHAT responses, which can be used to facilitate rapid matching of data.

3.3.1.2 Technical Description

A thorough knowledge of both the Operand Buffer and the Bool Buffer is necessary for a complete understanding of the BLOO routine. Appendices C and D detail the layout of these buffers. Before any explanation is made of the processing, a few definitions are necessary.

DEFINITIONS

stack — a stack functions as a last in - first out storage mechanism. Physically the stack constitutes a data table. There is a pointer designating the current end of stack. Whenever an item is taken from the stack, it is the last item that had been inserted. An item may be added to the stack or removed from the stack. To stack an item means to insert the item in the location indicated by the pointer and then increment the stack pointer.

popstack — to pop (or remove) an item from the stack is to decrement the stack pointer and then remove the item indicated by the pointer.

link	this is a function whereby two arguments (or parameters) are associated by having the first argument point to the second.
pointer	a pointer is merely an address of the location of some specific item in memory.
atom	the smallest element of an operand in a Boolean expression. In the case of the MDTRS, an atom represents one Heading or one Heading-Answer pair.
simple operand	an atom to the left or right of the operator in a Boolean expression.
complex operand	a simple Boolean expression made up of an operator and two operands (simple or complex), the expression itself to be used as an operand in another Boolean expression.
operator	symbol representing a Boolean function of either union or intersection.
terminal	the last call to BL00 indicating the end of the Boolean expression, is the terminal parameter call.
parameter	an element that makes up the Boolean expression. It may be one of the following: (1) left parenthesis (2) right parenthesis

(3) atom (simple operand)

(4) operator

(5) terminal.

node — a collection of memory locations containing the data necessary to determine the logical conclusion of a simple Boolean expression and the link to the next level of the expression. See Appendix C.

conclusion — the logical occurrence of an operand or expression, whereby, if X occurs, X union Y is true; or if Y occurs, X union Y is true; both X and Y must occur for X intersection Y to be true.

BASIC PROCESSING

There are five types of parameters in a legal Boolean expression in MDTRS (see definition of parameter). BL00 processes the entire expression one parameter at a time. Each type of parameter has its own specific processing which is composed of some combination of the following three functions: inserting an item onto a stack, removing an item from the stack, or linking two items together.

For use with the stack operations two stacks, A and B, are maintained in the MDTRS. Stack A contains items that are to be linked to the next operator in the Boolean expression. These items may be simple operands or operators

representing complex operands. Stack B contains left parentheses and operators that will be linked to by the next simple operand or complex operand.

ALGORITHM

The algorithm for the processing of the parameters contains five segments, one for each type of parameter. The algorithm will be listed here and will be followed by an example of its use.

1. [left parenthesis] . Stack B (left parenthesis)

2. [right parenthesis] . If Popstack B = left parenthesis, continue. Otherwise Link (Popstack A to Popstack B).

3. [atom] . If Popstack B empty or left parenthesis, Stack A (atom) and Stack B (left parenthesis). Otherwise Link (atom to Popstack B)

4. [op] Link (Popstack A to operator), Stack A (op) and Stack B (op)

5. [terminal] . a) If Popstack B is empty Link (Popstack A to NULL). b) Otherwise, if Popstack B is left parenthesis, Go to a. c) Otherwise Link (Popstack A to Popstack B) and Go to a.

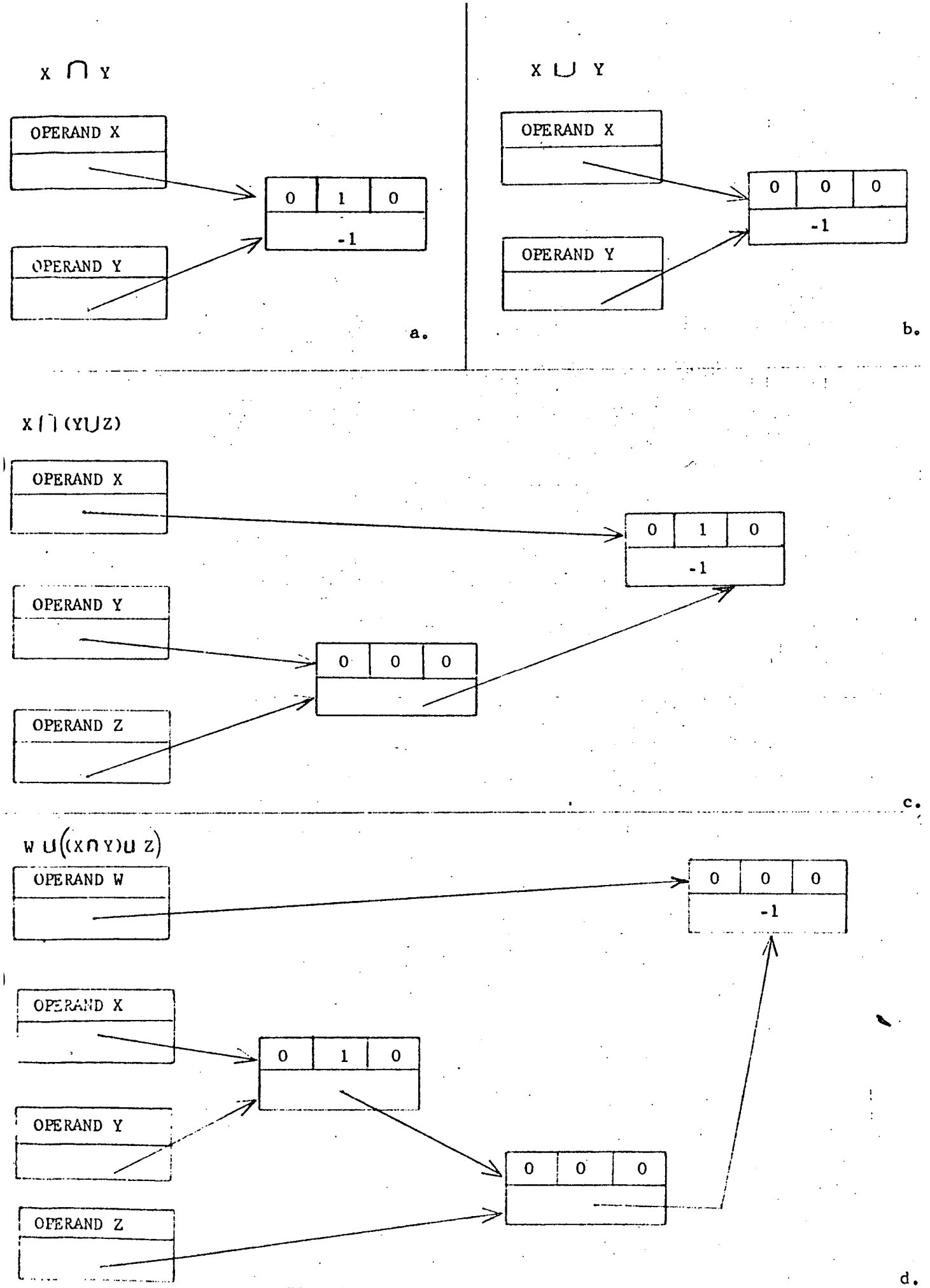


FIGURE 3-5 BOOLEAN TREES

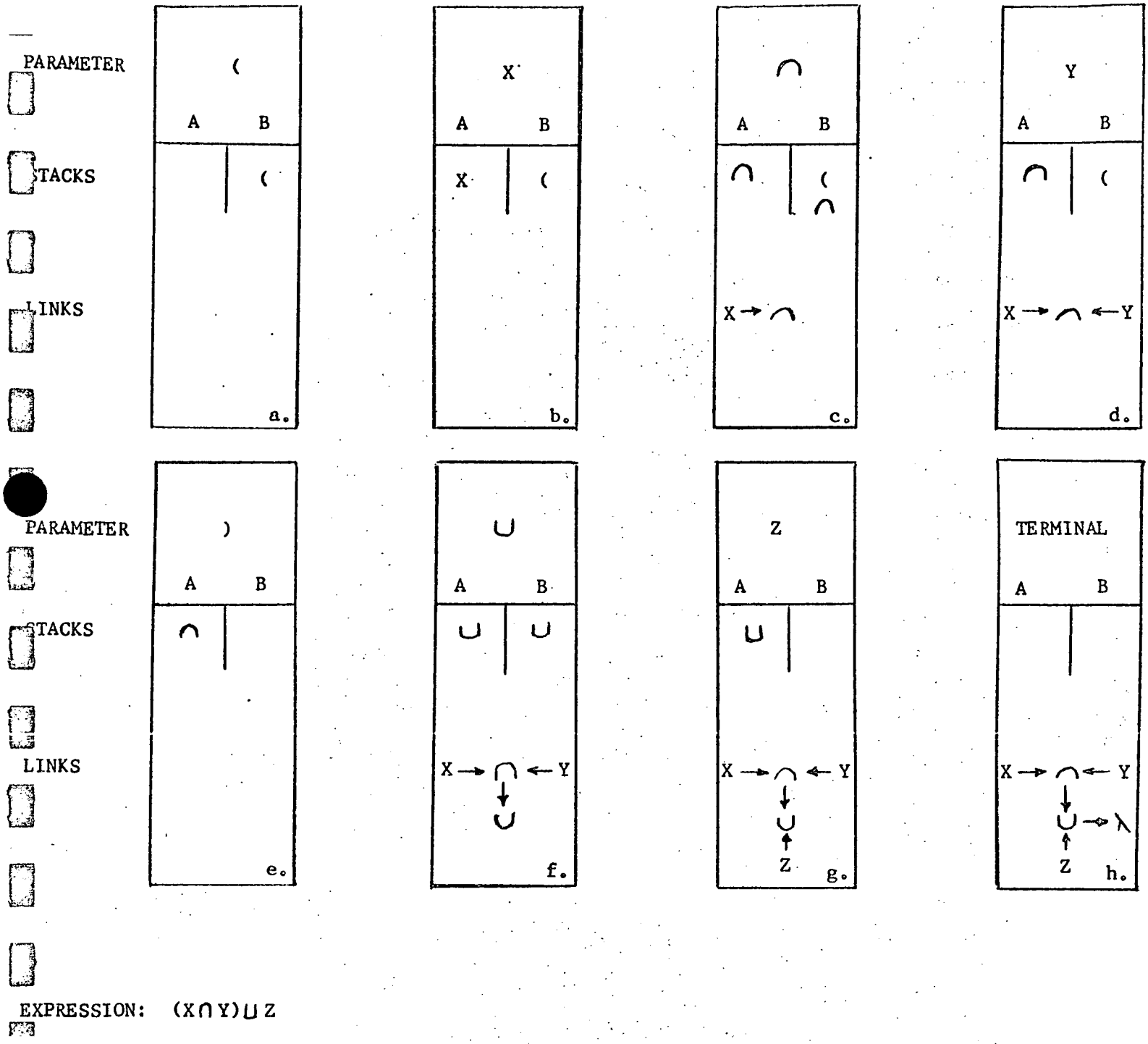


FIGURE 3-6 USE OF STACKS IN THE BOOLEAN ALGORITHM

Figure 3-5 illustrates four different Boolean trees that can be set up by this algorithm. In Figure 3-6 there is a step by step example of the algorithm. In each portion of the figure you can see the parameter that is being processed, the contents of each stack after the processing, and the new links, if any, between operand and operator. The links are illustrated by arrows, and the direction of the link by the direction of the arrow.

Initially, both Stacks A and B are empty and there are no links between parameters.

a. The left parenthesis is the parameter and it is added to Stack B. Eventually, this left parenthesis will be removed by a right parenthesis. However, it is saved to prevent the linking of any atom within the parenthesis to an operator outside the parenthesis.

b. The next parameter is an atom, X. Stack B is popped. If the last item on B is a left parenthesis, this atom is the atom to the left of the operator. Since the atom to the left is always linked to the operator immediately following, X will be saved in Stack A and will wait for the operator that is to follow. It is important that the left parenthesis that was removed from Stack B be replaced, since we have not yet found the right parenthesis that will remove it permanently.

c. With this operator, $\cap$, we will create our first link. The last item on Stack A is popped. This item is the atom X which has been waiting for the operator. The first link is set by linking X to the operator $\cap$. We must now add the operator to both stacks. It is added to B because it is waiting for the next simple or complex, operand which will link to $\cap$. The operator is added to A because represents a complex operand (X Y), and must be linked to an operator as all operands must.

d. Our next parameter is an atom Y. Stack B is popped and since the operator $\cap$ has been waiting for the operand Y, Y is linked to $\cap$. Looking at the links we can see that we have a complete expression $X \cap Y$. This expression is used as a complex operand in the expression $(X \cap Y) \cup Z$.

e. The right parenthesis is found now. This means that our simple expression X Y has been completely linked and there is no danger of illegal linking of the parameters that were within the parentheses. In some cases, when the Boolean expression consists of many nested expressions (e.g., $((X \cap Y) \cap Z) \cup (R \cap (S \cup T))$) the last item on Stack B will not be the left parenthesis that must be removed. In this event, the terminal processing will remove them. However, in our example here the left parenthesis is the last item and is removed.

f. The next parameter is the operator ⋃. At any time we have an operator we will also have an operand (simple or complex) on Stack A. Thus, we link Stack A to the operator ⋃ . Then ⋃ is placed on both stacks; on Stack B to wait for the next operand, and on Stack A because it represents a complex operand (in this case the entire expression) that must be linked to an operator.

g. The last operand is now received. It is immediately linked to the operator on Stack B.

h. There are no more parameters but we have some cleaning up to do in our stacks. This is done by examining Stack B. If B is empty we must link the item on Stack A to NULL (Λ). This null link indicates the top of the Boolean tree. If B had not been tmpty the last item on A would have been linked to the last item on B and the next item on B would have been examined as before.

3.3.1.2.1 Calling Sequence

CALL BLOO

REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	Parameter to be processed: 1 = left parenthesis 2 = right parenthesis 3 = operator 4 = atom (operand) 5 = terminal	N/A
B	link location in operand buffer if A-reg = 4 type of operator 0 = OR 1 = AND if A-reg = 3	N/A
X	N/A	N/A
Overflow	N/A	N/A

CALL SA00

REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	item to be added to Stack A	N/A
B	N/A	N/A
X	N/A	N/A
Overflow	N/A	N/A

CALL SB00

REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	item to be added to Stack B	N/A
B	N/A	N/A
X	N/A	N/A
Overflow	N/A	N/A

CALL PA00

REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	N/A	item removed from Stack A
B	N/A	N/A
X	N/A	N/A
Overflow	N/A	N/A

CALL PB00

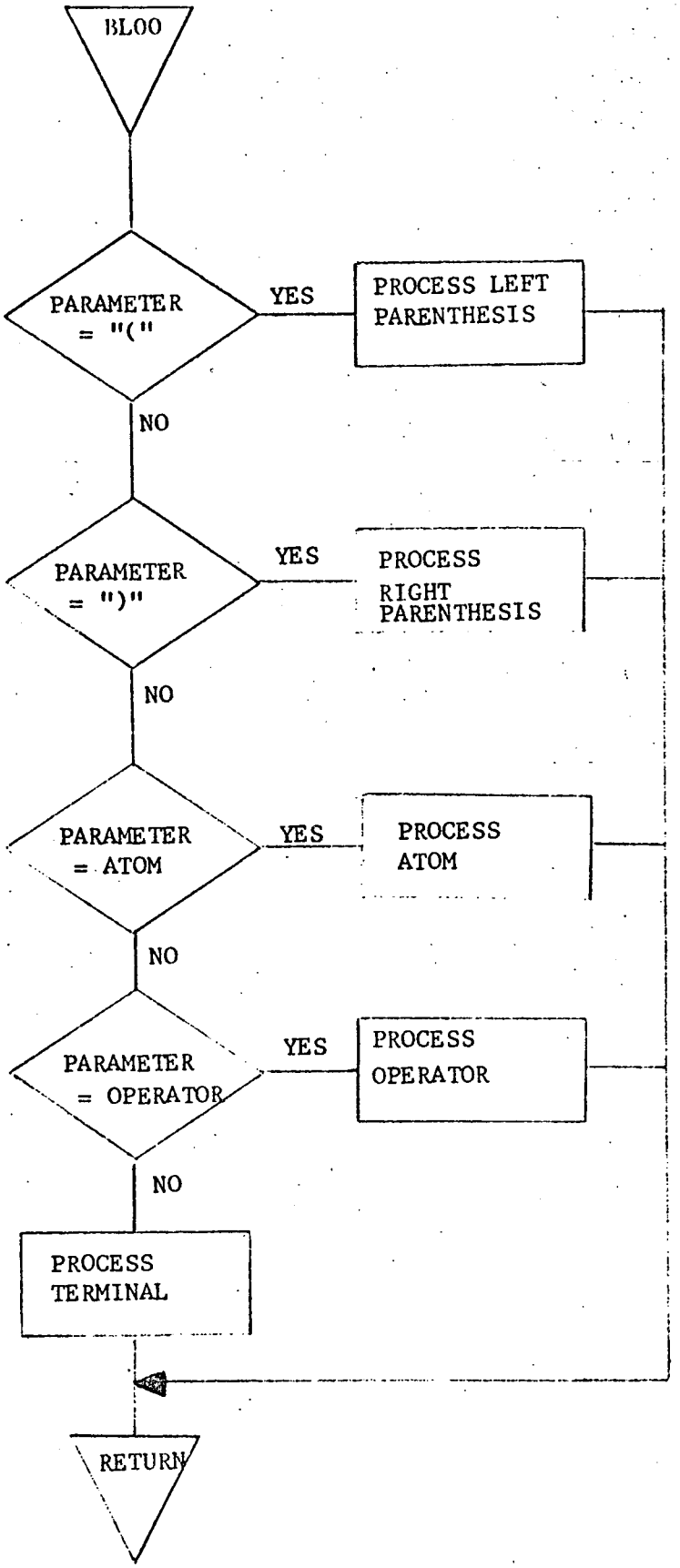
REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	N/A	item removed from Stack B
B	N/A	N/A
X	N/A	N/A
Overflow	N/A	N/A

CALL LK00, LKA, LKB

PARAMETER	FUNCTION
LKA	location where pointer is to be stored
LKB	pointer to be stored.

REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	N/A	N/A
B	N/A	N/A
X	N/A	N/A
Overflow	N/A	N/A

3.3.1.2.2 General Flow Chart



3.3.1.3 Label Description

3.3.1.3.1 Local

BLA	First argument in call to LK00
BLB	Second argument in call to LK00
BLSA	Stack A Buffer
BLSV	Save location
BLXA	Stack A Pointer
BLXB	Stack B Pointer
BLSB	Stack B Buffer
LKA	First argument in call
LKB	Second argument in call

3.3.1.3.2 Global

None

3.3.1.3.3 Entry Points

BL00

LK00

PA00

PB00

SA00

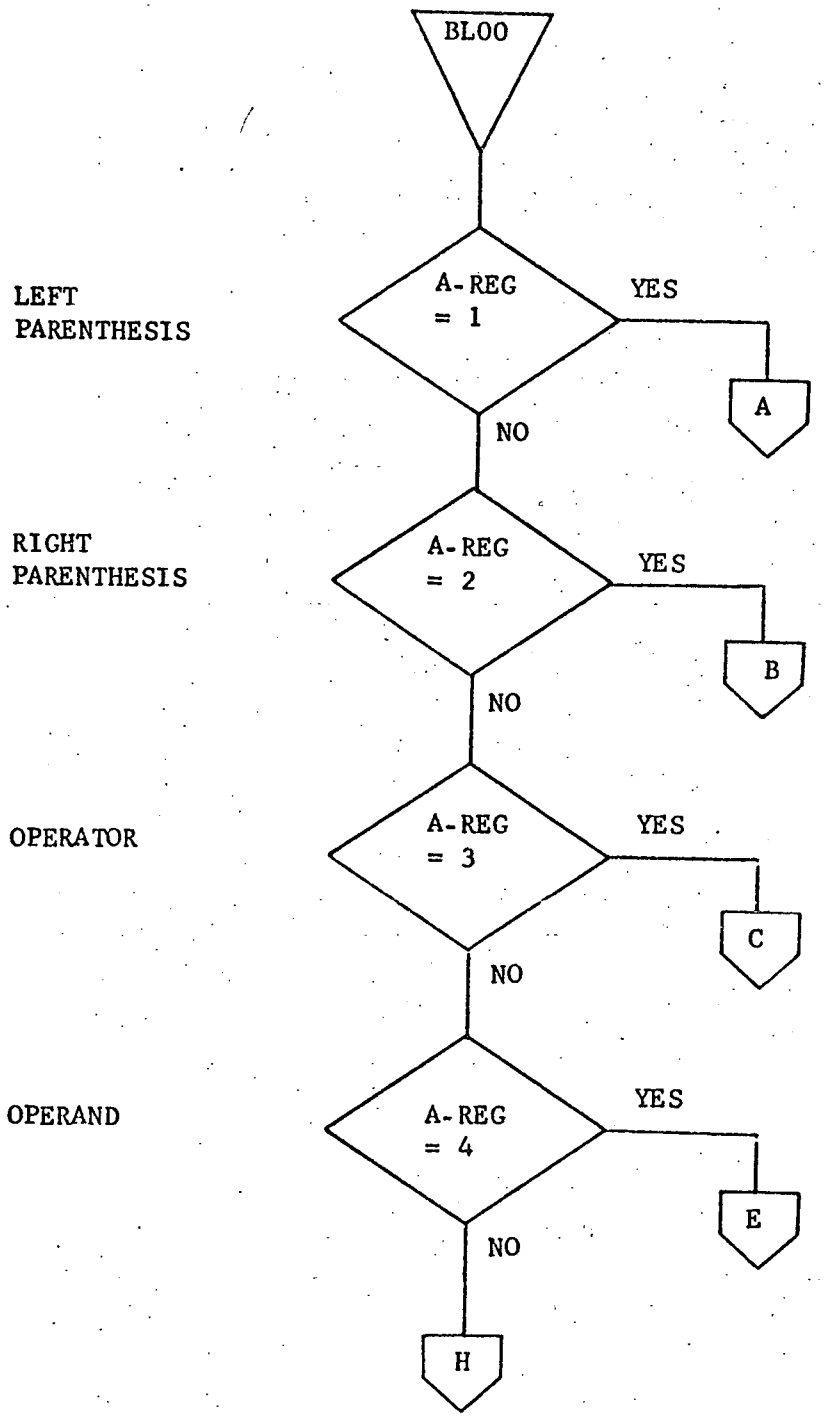
SB00

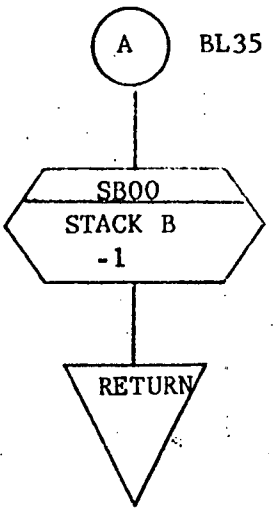
3.3.1.3.4 External References

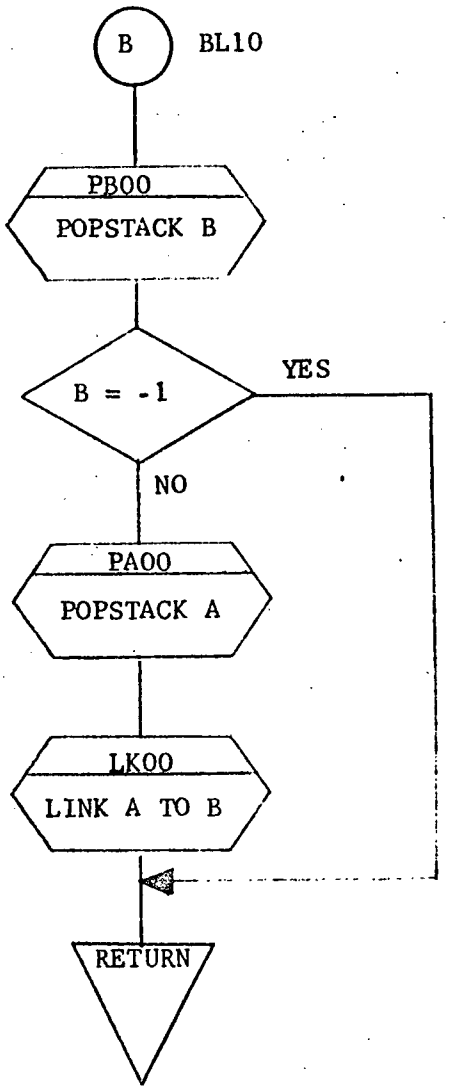
CPXB Bool Buffer pointer

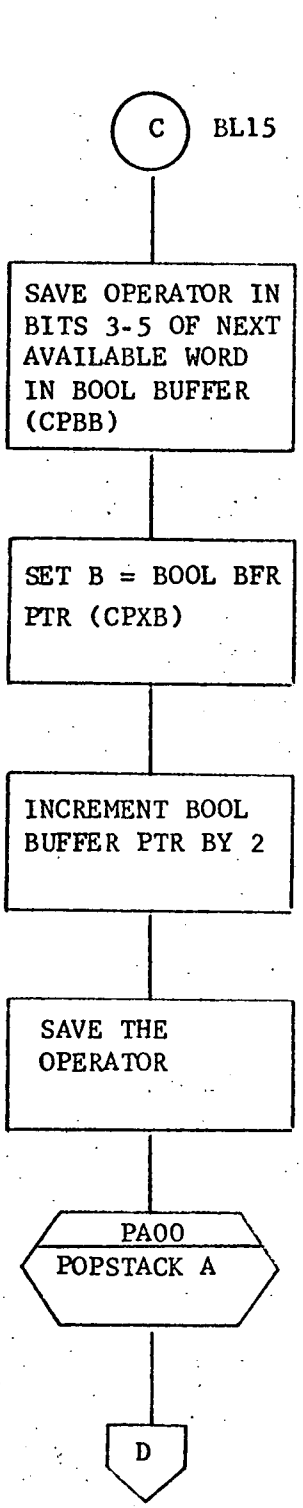
$SE routine to pick up a calling sequence

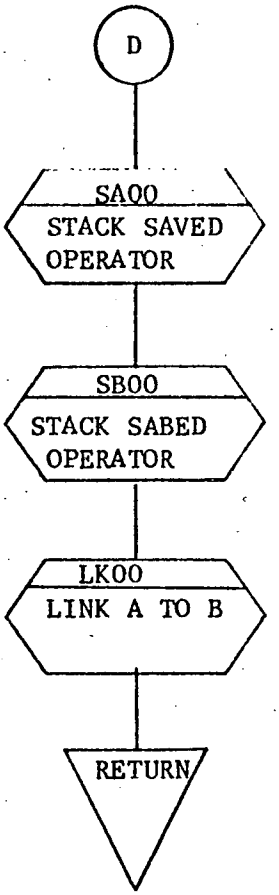
3.3.1.4 Detailed Flow Chart

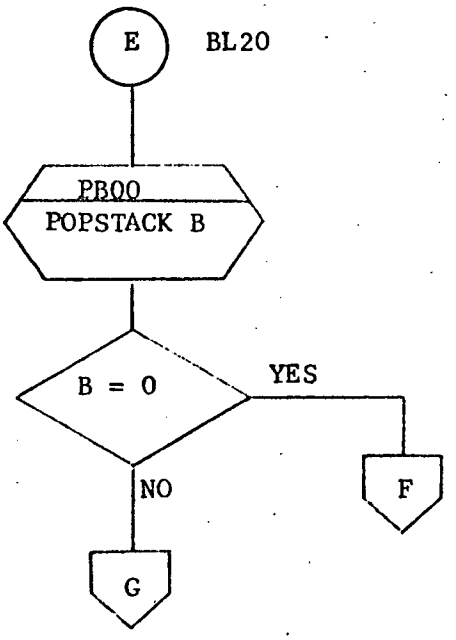


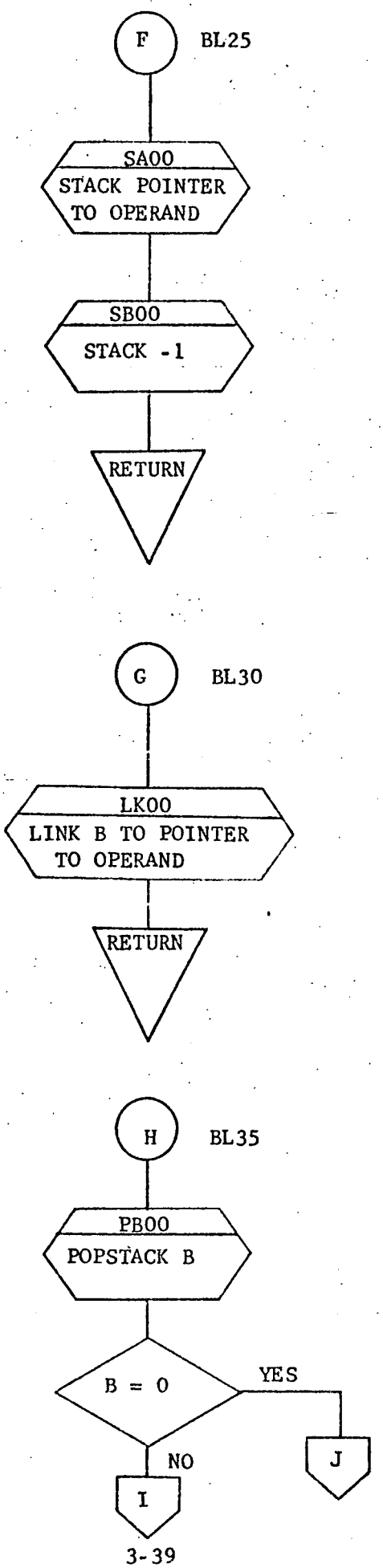

A
BL35
SB00
STACK B
-1
RETURN

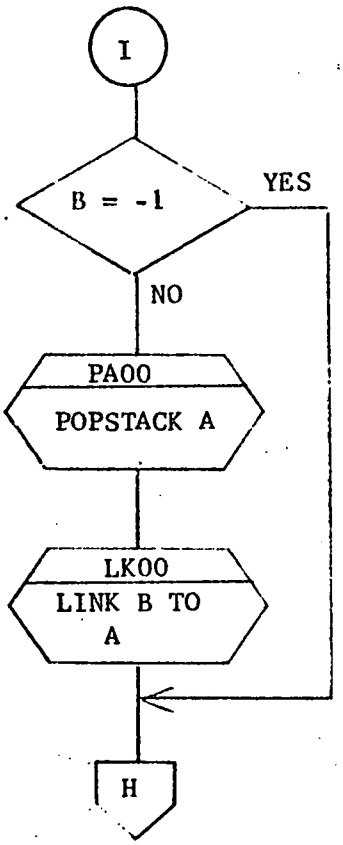

B
BL10
PB00
POPSTACK B
B = -1
YES
NO
PA00
POPSTACK A
LK00
LINK A TO B
RETURN

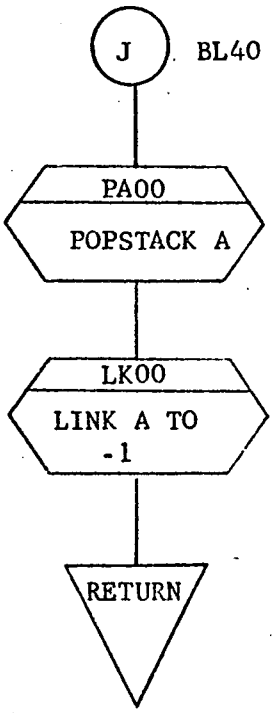

C
BL15
SAVE OPERATOR IN BITS 3-5 OF NEXT AVAILABLE WORD IN BOOL BUFFER (CPBB)
SET B = BOOL BFR PTR (CPXB)
INCREMENT BOOL BUFFER PTR BY 2
SAVE THE OPERATOR
PA00
POPSTACK A
D

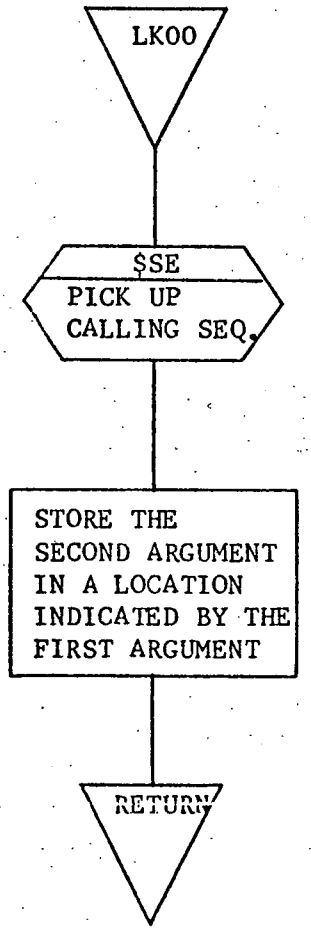

D
SA00
STACK SAVED
OPERATOR
SB00
STACK SABED
OPERATOR
LK00
LINK A TO B
RETURN

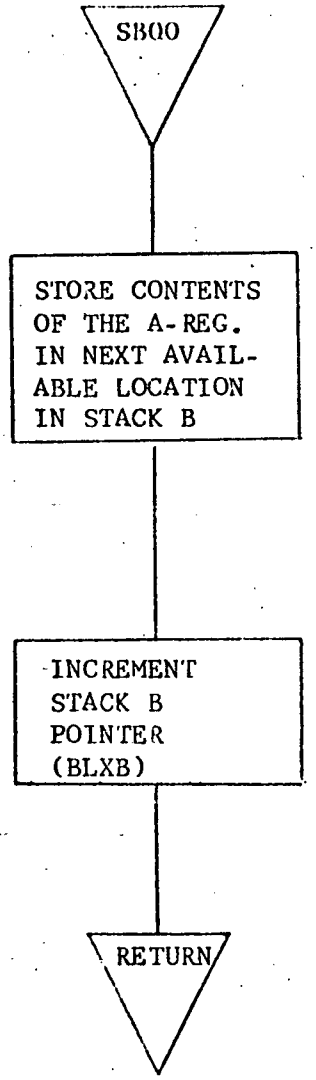

E
BL20
PB00
POPSTACK B
B = 0
YES
NO
F
G


F
BL25
SA00
STACK POINTER
TO OPERAND
SB00
STACK -1
RETURN
G
BL30
LK00
LINK B TO POINTER
TO OPERAND
RETURN
H
BL35
PB00
POPSTACK B
B = 0
YES
NO
J
I

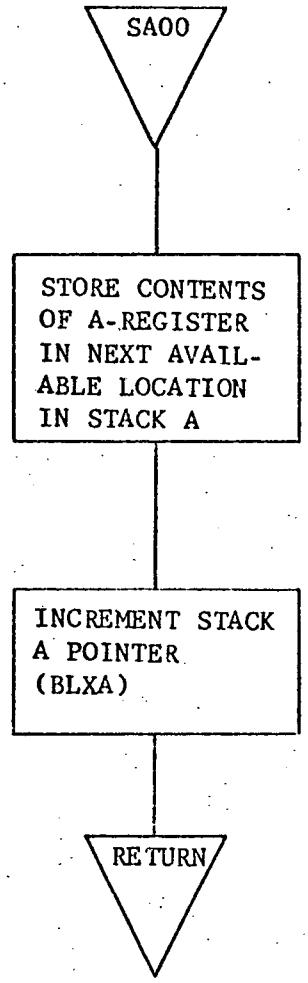

I
B = -1
YES
NO
PA00
POPSTACK A
LK00
LINK B TO
A
H

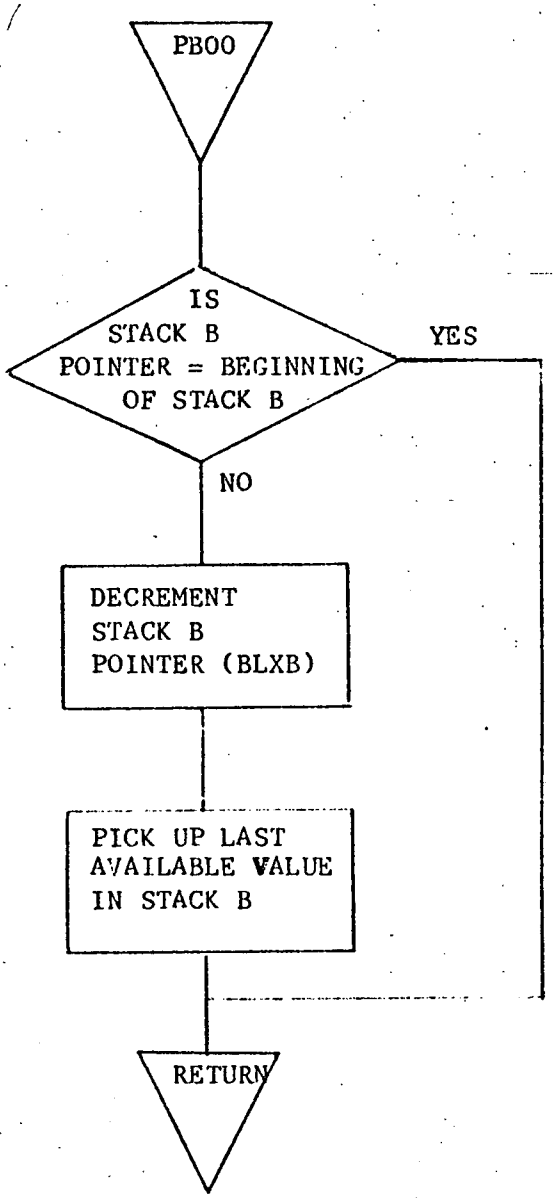

J
BL40
PA00
POPSTACK A
LK00
LINK A TO
-1
RETURN

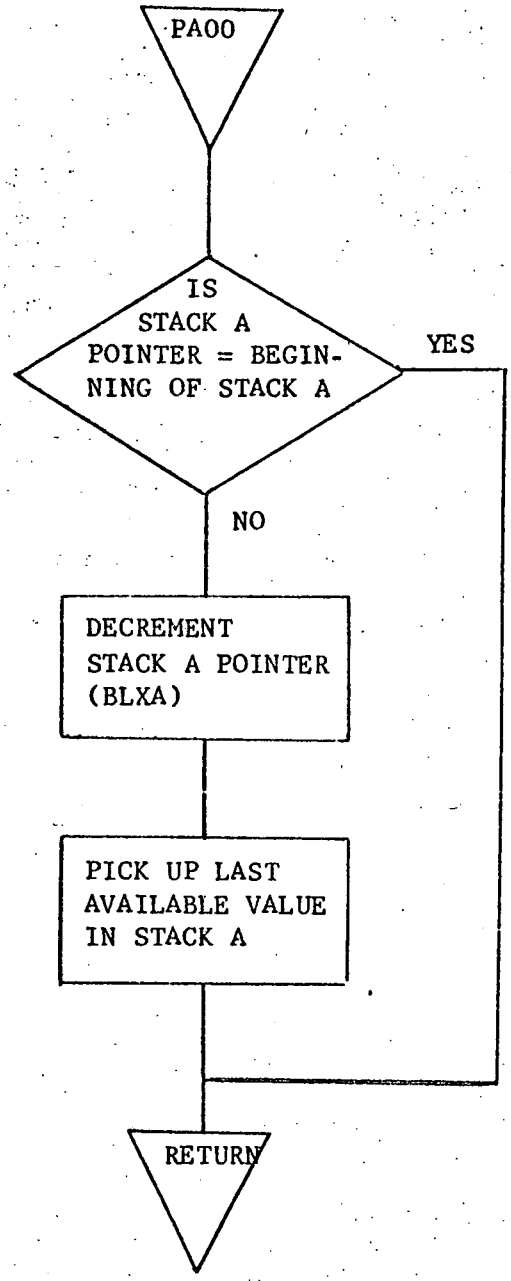

LKOO
$SE
PICK UP
CALLING SEQ.
STORE THE
SECOND ARGUMENT
IN A LOCATION
INDICATED BY THE
FIRST ARGUMENT
RETURN


SB00
STORE CONTENTS OF THE A-REG. IN NEXT AVAIL-ABLE LOCATION IN STACK B
INCREMENT STACK B POINTER (BLXB)
RETURN

20


SA00
STORE CONTENTS OF A-REGISTER IN NEXT AVAIL-ABLE LOCATION IN STACK A
INCREMENT STACK A POINTER (BLXA)
RETURN


PB00
IS
STACK B
POINTER = BEGINNING
OF STACK B
YES
NO
DECREMENT
STACK B
POINTER (BLXB)
PICK UP LAST
AVAILABLE VALUE
IN STACK B
RETURN


PA00
IS STACK A POINTER = BEGIN-NING OF STACK A
YES
NO
DECREMENT STACK A POINTER (BLXA)
PICK UP LAST AVAILABLE VALUE IN STACK A
RETURN

3.3.2 CD00 - Convert Date

3.3.2.1 Purpose

CD00 is a subroutine whose purpose is to take a month which is stored in the Tape Input Buffer in integer form and convert that number to a corresponding three character alpha equivalent and store it into a buffer for later processing.

3.3.2.2 Technical Description

CD00 picks up the integer number corresponding to the month from the Tape Input Buffer. Using the integer as an index, the corresponding three alpha character entry in the Month Conversion Table CDTB is accessed and output, a character at a time, by calling the pack routine PK01 three times in succession. If the value of the integer is greater than 15, an entry of 'UNK' is assigned. The Month Conversion Table CDTB is given in Figure 3-7.

3.3.2.2.1 Calling Sequence

```
CALL    CD00
```

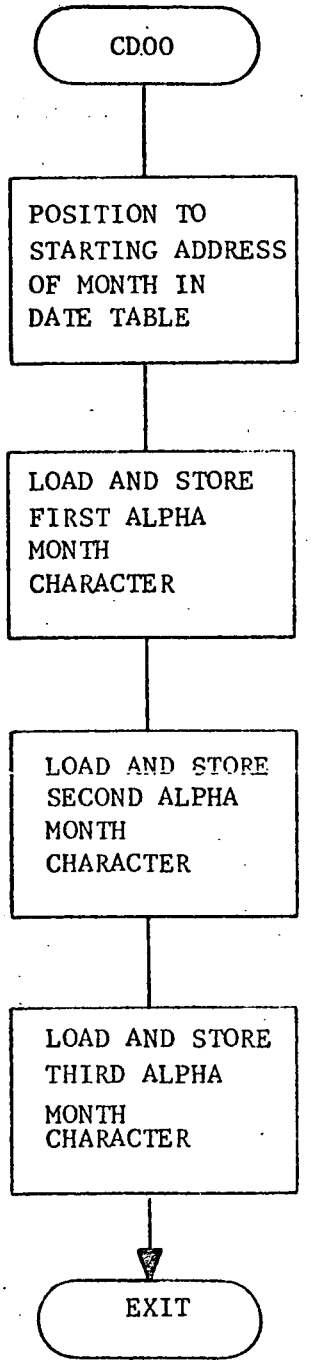
REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	N/A	Contents unpredictable
B	N/A	Contents unpredictable
X	N/A	N/A
Overflow	N/A	N/A

MONTH CONVERSION TABLE (CDTB)

Integer	Alpha Equivalent
0	UNK (unknown)
1	JAN
2	FEB
3	MAR
4	APR
5	MAY
6	JUN
7	JUL
8	AUG
9	SEP
10	UNK
11	UNK
12	UNK
13	OCT
14	NOV
15	DEC
>15	UNK

Figure 3-7

3.3.2.2.2 General Flow Chart



3.3.2.3 Label Description

3.3.2.3.1 Local

CDTB - A 48 word table containing the alpha designation for each month of the year. In addition, space has been allocated for those additional entries which are to be designated as 'UNK' (i.e., unknown).

3.3.2.3.2 Global

None

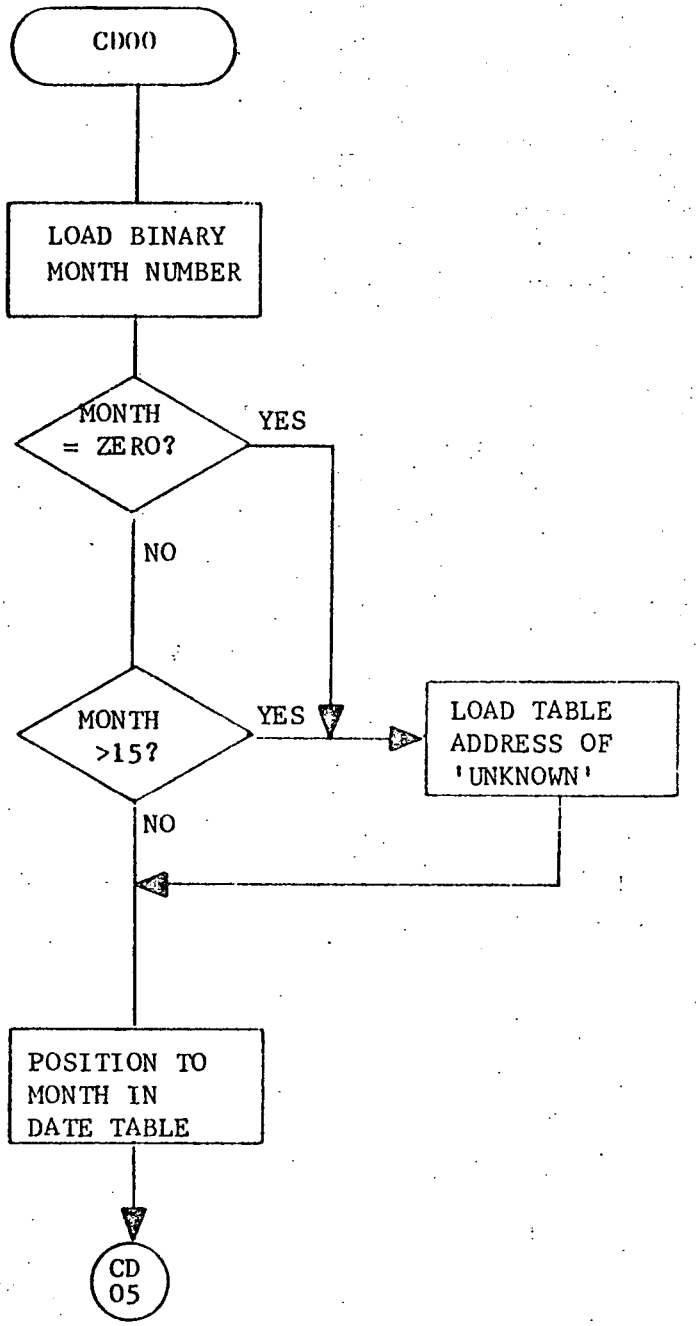
3.3.2.3.3 Entry Point

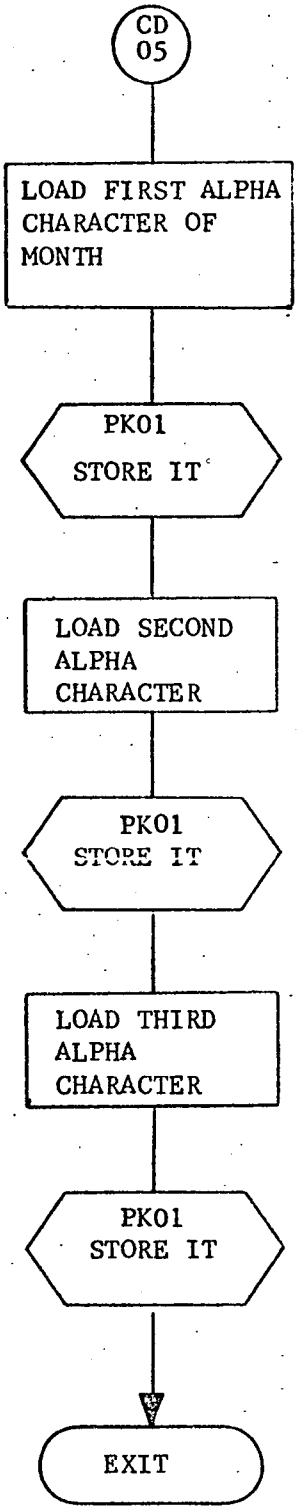
CD00 - primary entry point

3.3.2.3.4 External References

PK01 - pack character routine

3.3.2.4 Detailed Flow Chart




CD
05
LOAD FIRST ALPHA CHARACTER OF MONTH
PK01
STORE IT
LOAD SECOND ALPHA CHARACTER
PK01
STORE IT
LOAD THIRD ALPHA CHARACTER
PK01
STORE IT
EXIT

3.3.3 CM00 - Compare

3.3.3.1 Purpose

CM00 is a subroutine whose purpose is to compare two strings of alphanumeric characters.

3.3.3.2 Technical Description

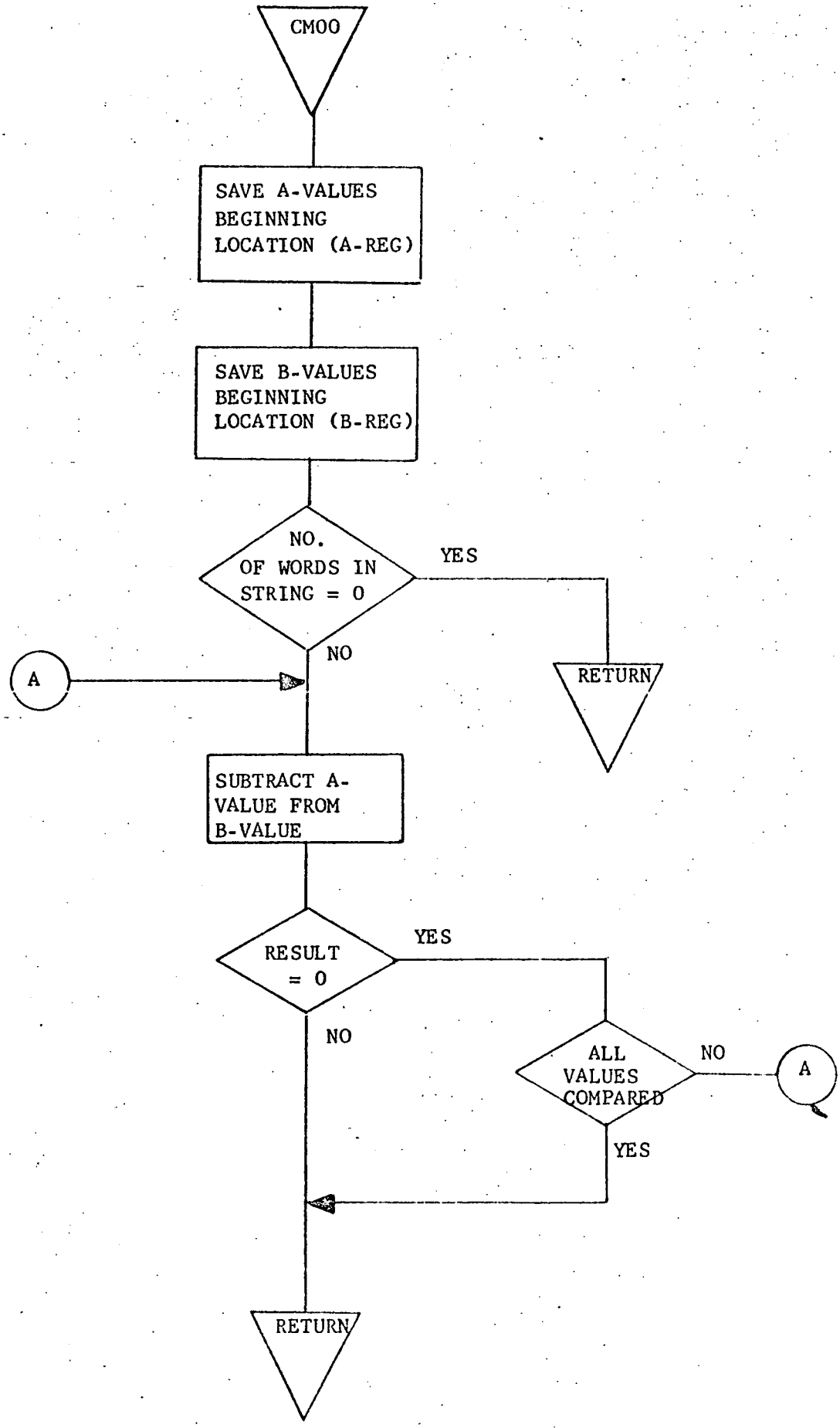
Starting locations of the two strings of alphanumeric characters to be compared are passed to the routine via the A and B registers. CM00 then does a word by word compare on the two character strings. If the two strings are identical, control is returned to the calling program with a zero in the A-register; otherwise a non zero value is stored in the A-register. The two alphanumeric character strings are assumed to be the same length.

3.3.3.2.1 Calling Sequence

CALL CM00

REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	beginning location of first data value	zero if values equal, otherwise, unpredictable
B	beginning location of second data value	unpredictable
X	Number of characters to compare	unpredictable
Overflow	N/A	N/A

3.3.3.2.2 General Flow Chart



3.3.3.3 Label Description

3.3.3.3.1 Local

AVAL storage location containing the beginning address of one of the values to be compared

BVAL storage location containing the beginning address of the second value to be compared

3.3.3.3.2 Global

N/A

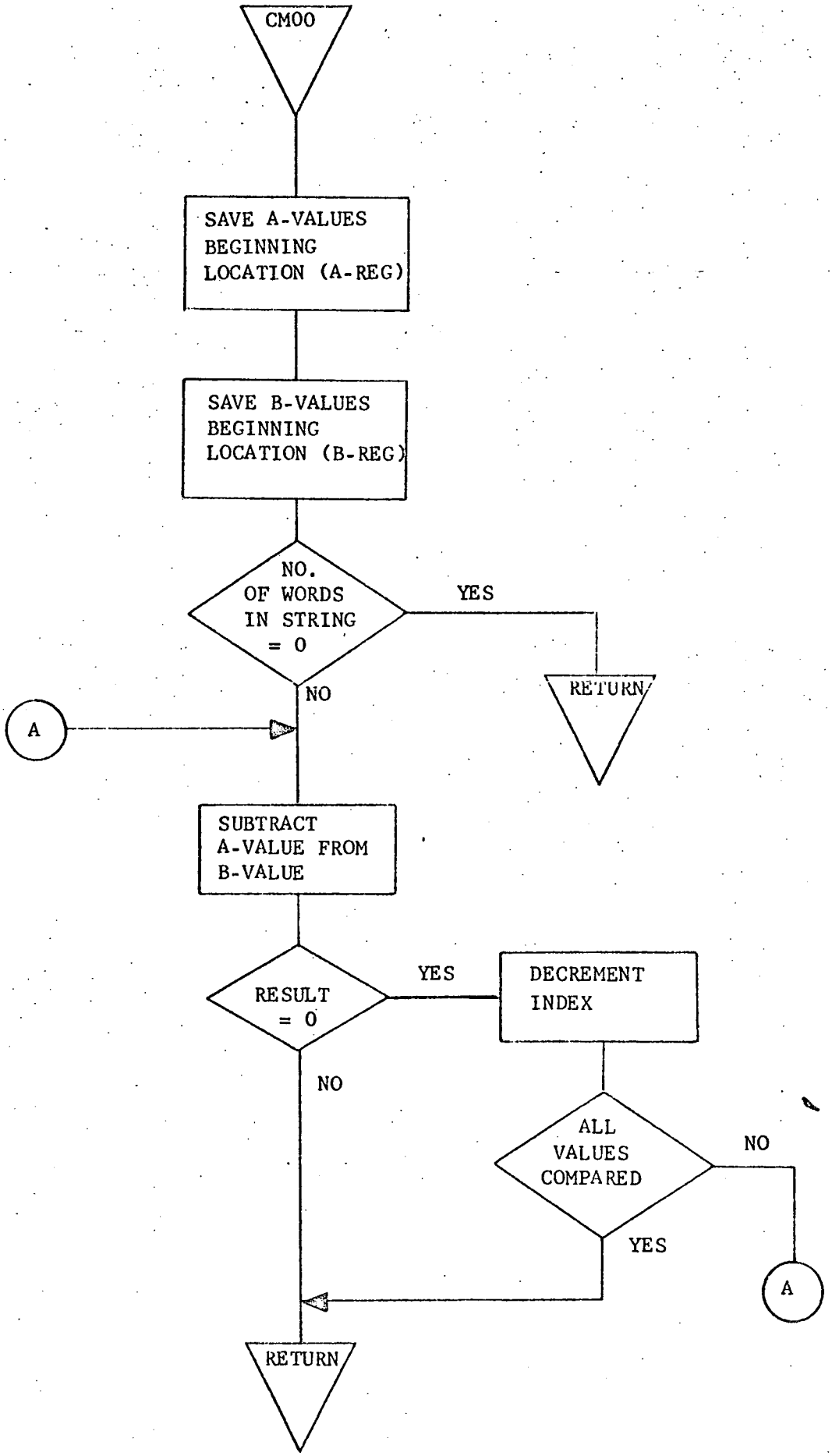
3.3.3.3.3 Entry Points

CM00 - primary entry point

3.3.3.3.4 External References

N/A

3.3.3.4 Detailed Flow Chart



3.3.4 CP00 - Control Program

3.3.4.1 Purpose

The purpose of CP00 is to control the execution of all processing and input/output routines. In this manner, CP00 provides a modular system which simplifies development, checkout, and maintenance of the software.

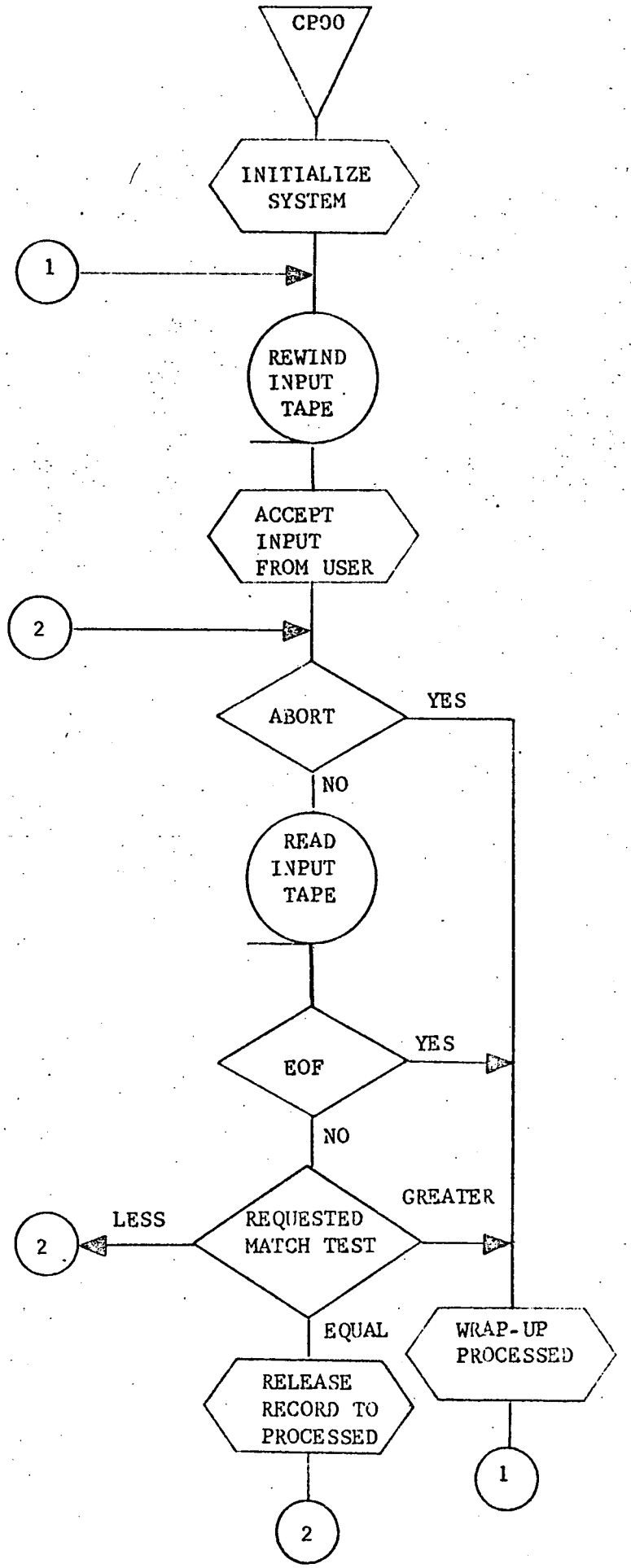
3.3.4.2 Technical Description

CP00 initializes the system by calling the Initialize System Routine IS00, rewinding the input tape, and clearing the request buffers. The Request User Input (RQ00) routine is executed to accept the retrieval request from the user. The data tape is read by the Magnetic Tape Handler (HM00) and the Record Match Routine (RM00) is executed. If a record match occurs, CP00 calls the appropriate format routine LIST, COPY, COUNT, TABULATE OR ANALYZE. When a tape end of file or a request-greater-than-master-record condition occurs, the appropriate wrap-up routine for the requested output format is executed and the "OUTPUT COMPLETE" message is displayed. The next request is then accepted by the RQ00 routine again. If no matches are found, the entire file will be searched (except when "GREATER THAN" condition on control data occurs) and the only output to the requestor terminal will be the "OUTPUT COMPLETE" message.

If the user aborts the retrieval in progress, the messages "RETRIEVAL ABORTED" and "OUTPUT TERMINATED" are displayed after the appropriate wrap-up routine has been executed.

3.3.4.2.1 Calling Sequence

None


CP00
INITIALIZE SYSTEM
1
REWIND INPUT TAPE
ACCEPT INPUT FROM USER
2
ABORT
YES
NO
READ INPUT TAPE
EOF
YES
NO
REQUESTED MATCH TEST
LESS
GREATER
2
EQUAL
WRAP-UP PROCESSED
RELEASE RECORD TO PROCESSED
1
2
CP00

3.3.4.3 Label Description

3.3.4.3.1 Local

CPAF Abort Flag

CPBK Backspace-constant value 6

CPCU Maximum number of words to be read from tape; value 2880

CPEA End function; Indicator for What Format Wrap-up Routine to call.

CPFU Function Table; Indicator for What Format Routine to call. See Table 2 in 3.3.4.2 for details.

CPMC Table containing addresses of processing to be done for each of the three record match conditions, low, equal, or greater.

CPRD Tape read function code of 0

CPRW Tape function code of 7

CPTE Tape read error count

CPTP Table containing addresses of processing to be done for each of the possible tape status codes returned by the tape handler HM00.

3.3.4.3.2 Global

CPBB Bool buffer; 40 words in length; See Appendix F for details; Referenced by RQ00, RC00

CPNC Number of characters in retrieval question. Referenced by RQ00.

CPOB Operator buffer; 40 words in length; See Appendix D for detail referenced by RQ00, RC00

CPRB Request buffer; 480 words in length; See Appendix E for details; Referenced by RQ00, RS00

3.3.4.3.2 Global (Continued)

CPRT Request Table; See Appendix B for details; Referenced by RQ00, RS00, RR00, and RDD0, RC00, RA00, RM00, MD00, MC00, MW00, CT00, TA00, LI00

CPTB Tape buffer, 2880 words in length; See Appendix A for layout, referenced by RA00, MA00, LI00, CY00, CT00, TA00.

CPSW Status Word for user I/O device. Number of characters input or output referenced by RQ00, RS00, RR00, RA00 and CY00

CPTS Tape status set to negative value when abnormal condition arises, set to positive value is the number of words written, referred by CY00

CPWT What Buffer; 20 words in length; See Appendix G for detail, referenced by RQ00, RC00

CPXB Bool buffer pointer. Referenced by RQ00, RC00

CPXC Condition buffer pointer, referenced by RQ00, RC00

CPXO Operand buffer pointer, referenced by RQ00, RC00

CPXR Request buffer pointer, referenced by RQ00, RS00, RR00, RD00

3.3.4.3.3 Entry Point

N/A

3.3.4.3.4 External References

CT00 Subroutine to COUNT

CT10 Subroutine ENTRY POINT to close COUNT subroutine

CY00 Subroutine to Copy Data Tape

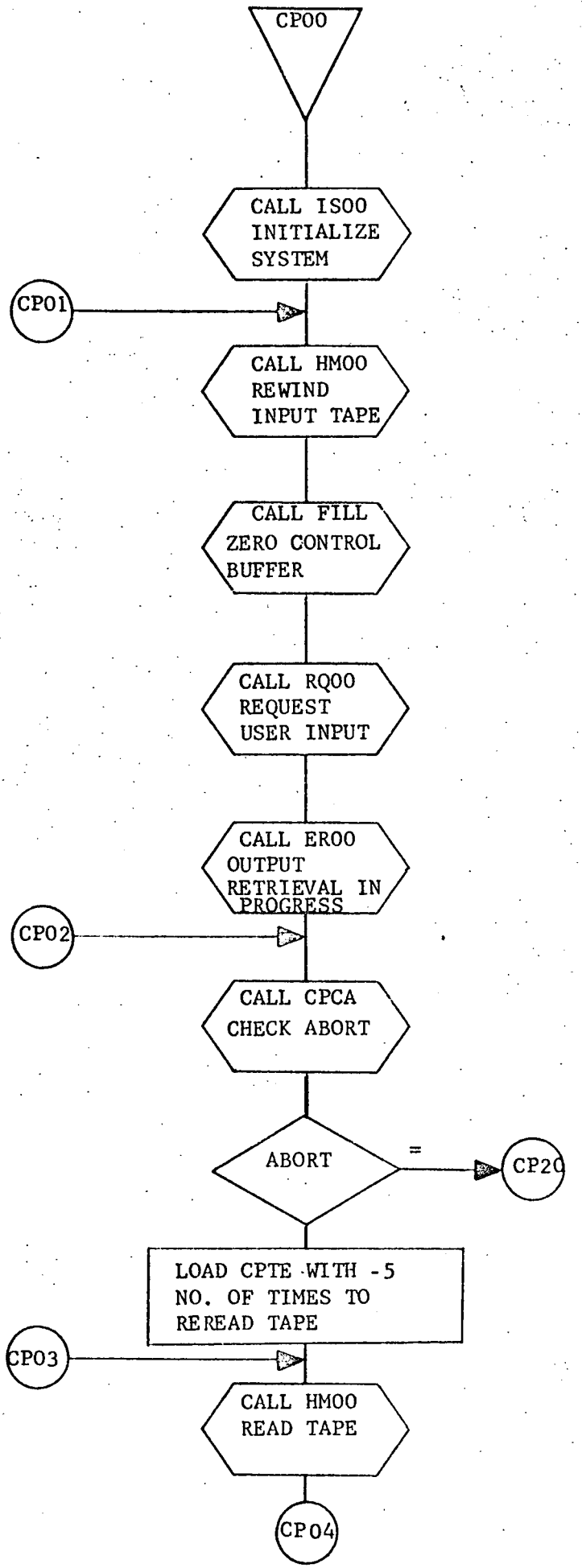
CY20 Subroutine ENTRY POINT to Close Copy subroutine

CY00 Subroutine to Copy Data Tape

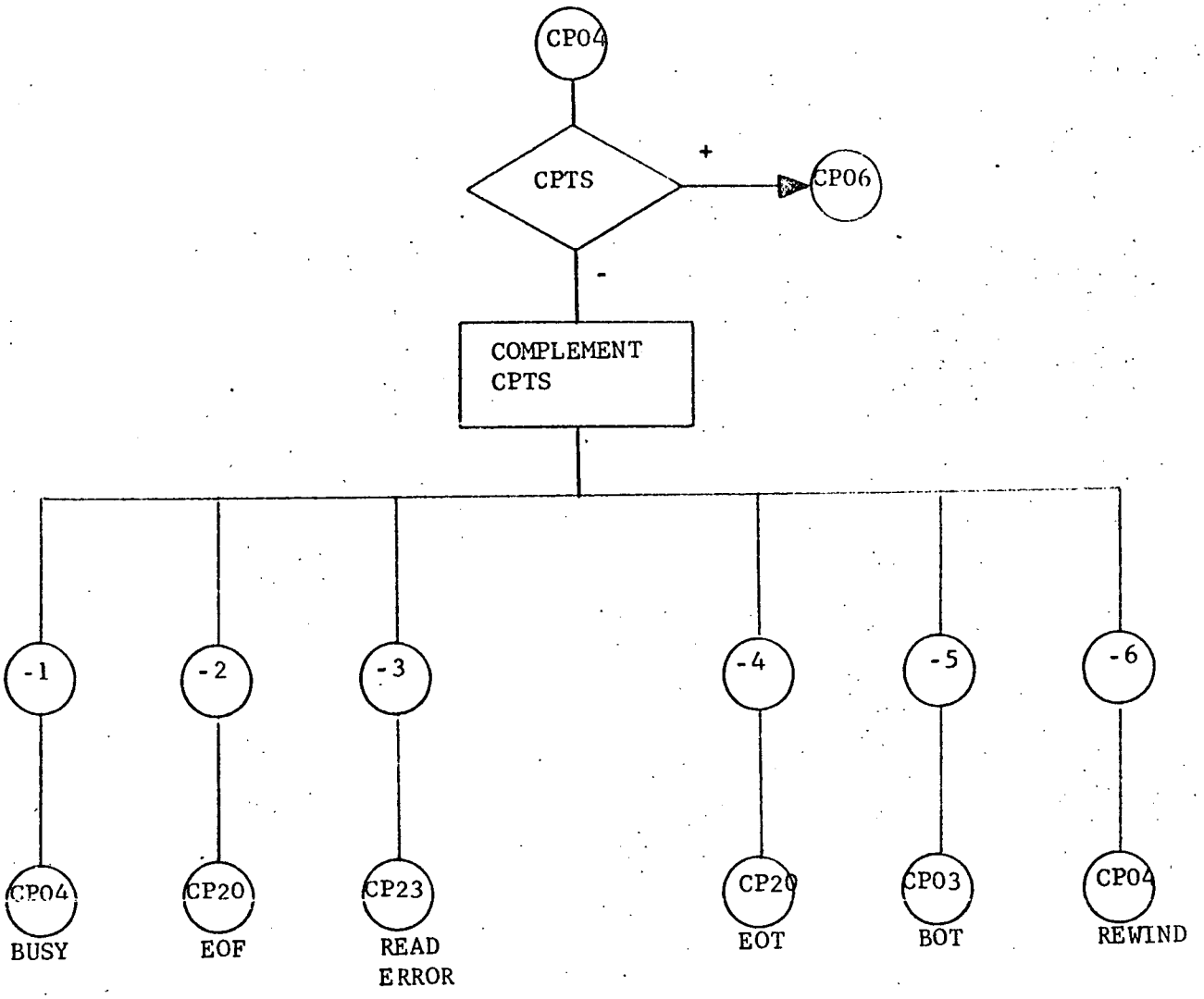
3.3.4.3.4 External References (Continued)

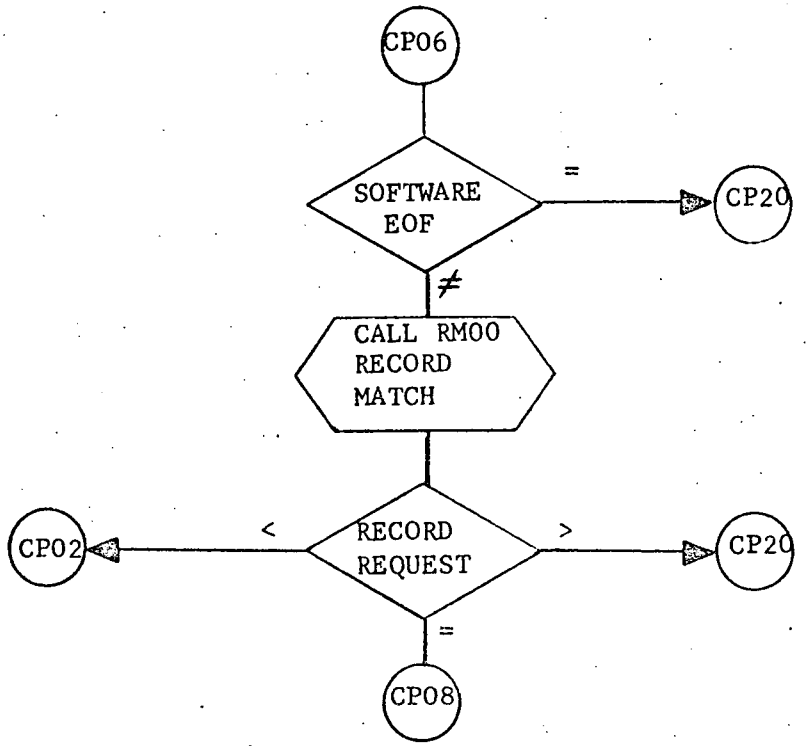
CY20	Subroutine ENTRY POINT to Close Copy subroutine
ER00	Subroutine to Output Message to User
FILL	Subroutine to Clear Buffer
HM00	Subroutine to handle the input tape
IS00	Subroutine to initialize the program
LI00	Subroutine to output LIST
LI$7	Subroutine to close ENTRY POINT LIST subroutine
OMHC	Defined in OMHC; Header switch, clear to zero; CP00 at end of the retrieval
RM00	Subroutine to match record buffer with request buffer
RQ00	Subroutine to accept request data from the user
TAA0	Subroutine ENTRY POINT to close TABULATE subroutine
TAA1	Subroutine ENTRY POINT to close ANALYZE subroutine
TA00	Subroutine to tabulate and analyze

3.3.4.4 Detailed Flow Chart

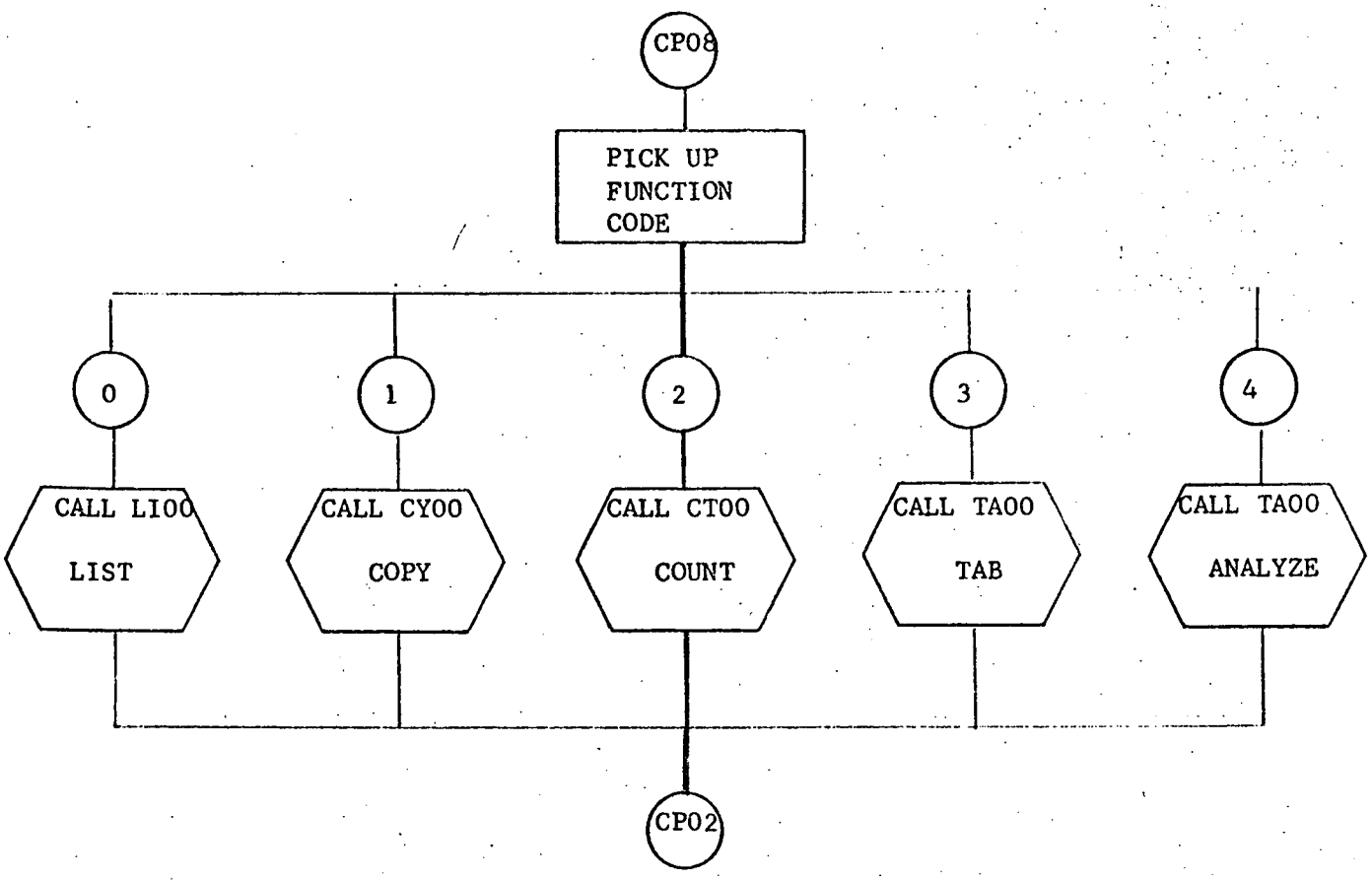


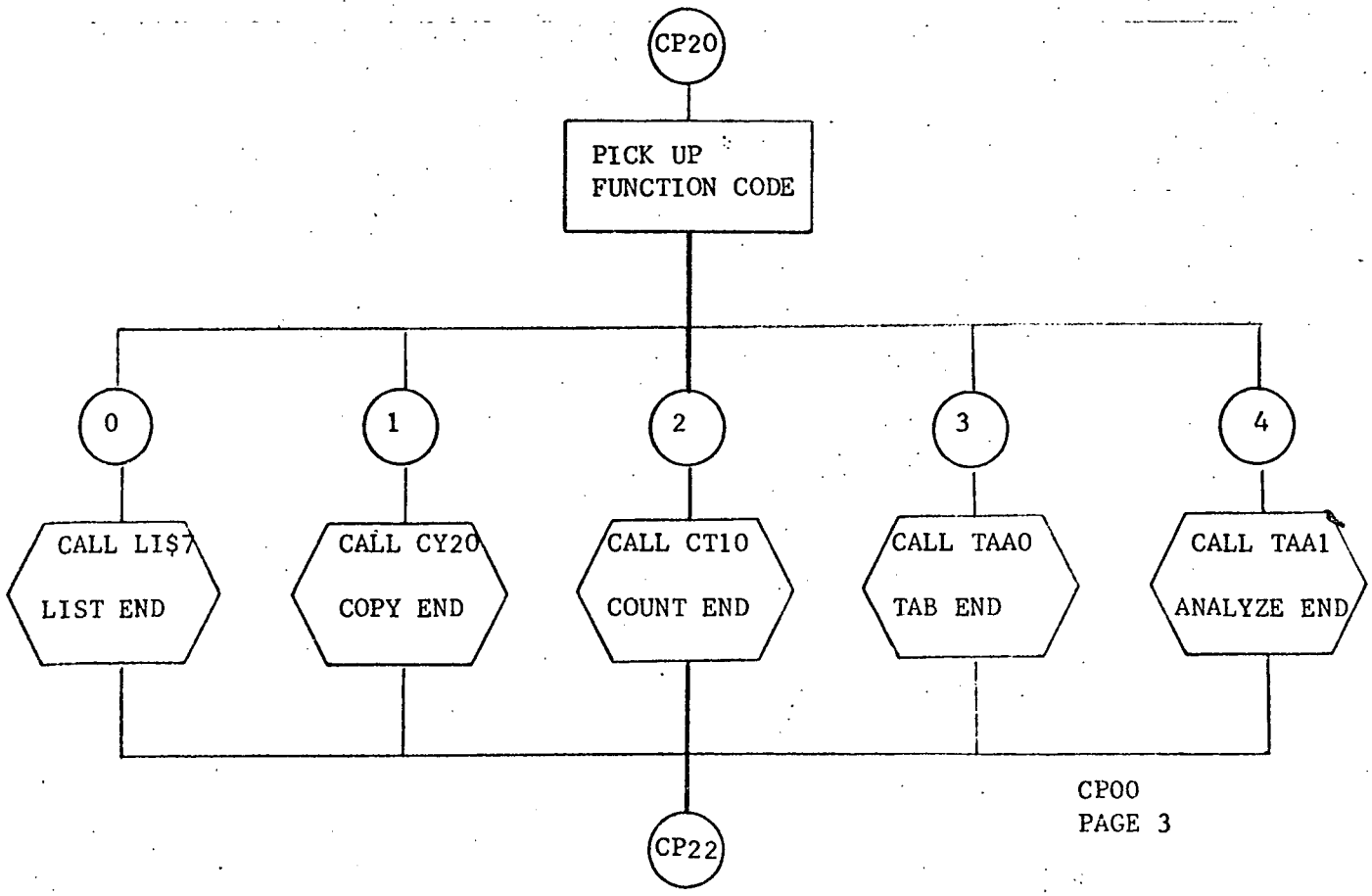
CP00
PAGE 1


CP04
CPTS
+
CP06
-
COMPLEMENT CPTS
-1
-2
-3
-4
-5
-6
CP04
BUSY
CP20
EOF
CP23
READ ERROR
CP20
EOT
CP03
BOT
CP04
REWIND

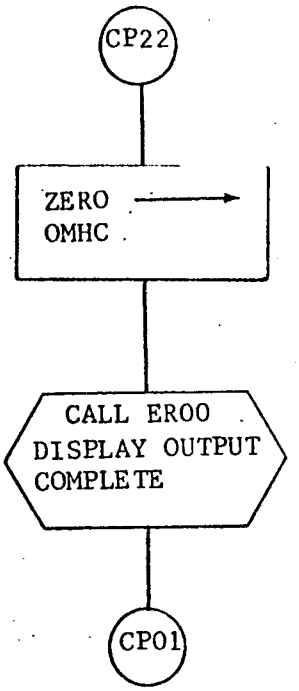

CP06
SOFTWARE EOF
=
CP20
≠
CALL RM00 RECORD MATCH
CP02
<
RECORD REQUEST
>
CP20
=
CP08

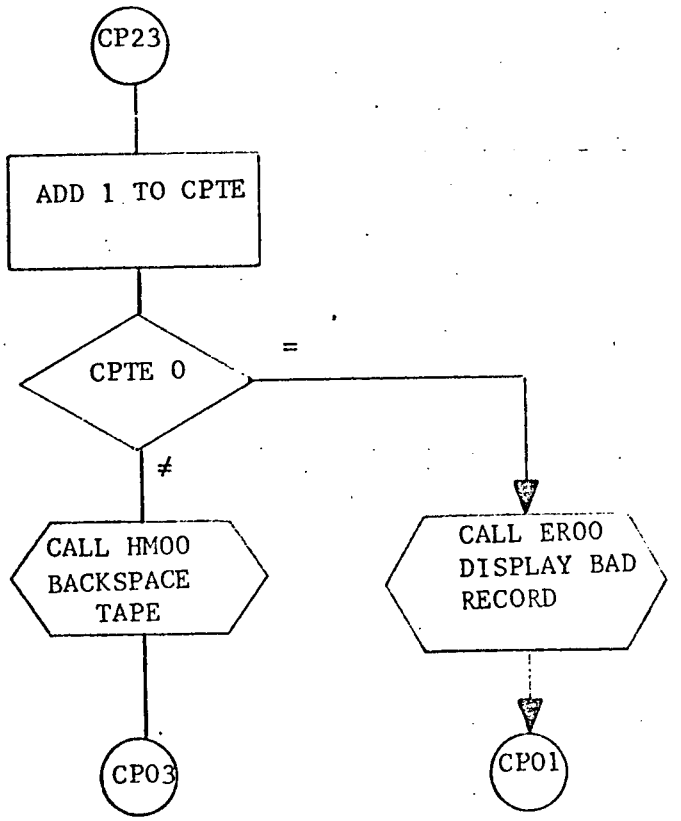
CP00
PAGE 2


CP08
PICK UP FUNCTION CODE
0
1
2
3
4
CALL LI00 LIST
CALL CY00 COPY
CALL CT00 COUNT
CALL TA00 TAB
CALL TA00 ANALYZE
CP02

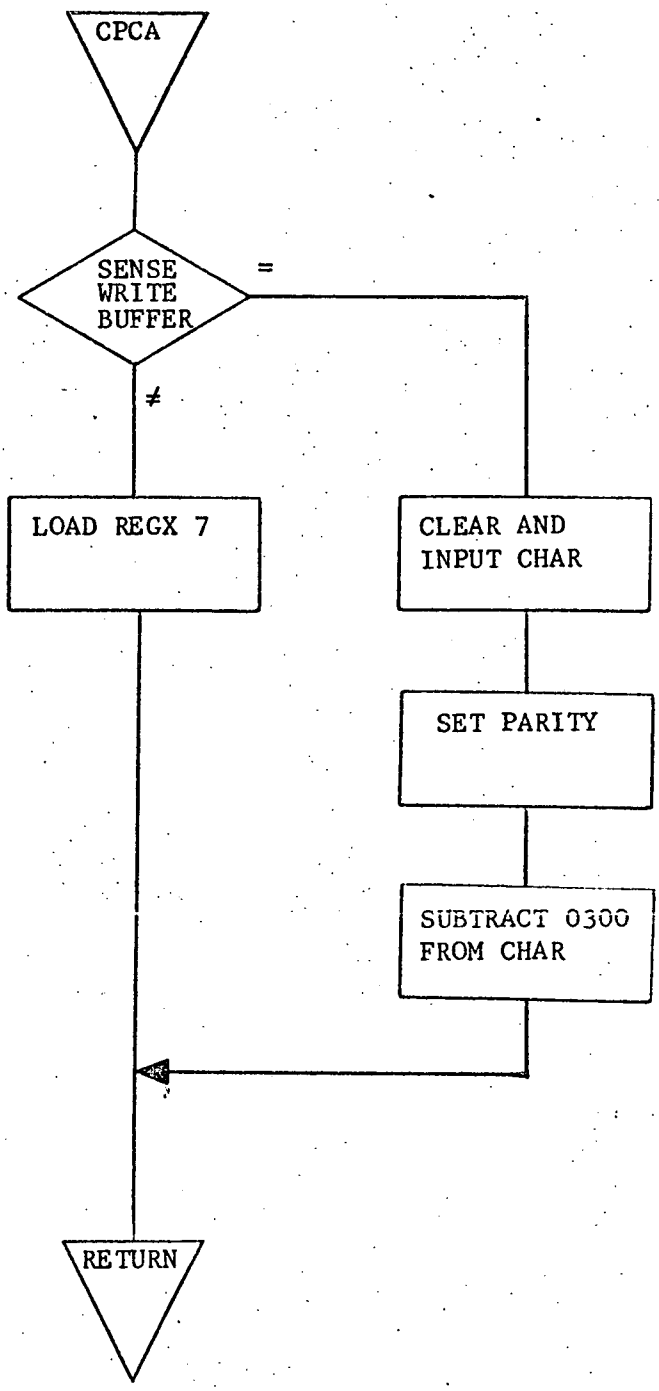

CP20
PICK UP FUNCTION CODE
0
1
2
3
4
CALL LI$7 LIST END
CALL CY20 COPY END
CALL CT10 COUNT END
CALL TAA0 TAB END
CALL TAA1 ANALYZE END
CP22

CP00
PAGE 3


CP22
ZERO
OMHC
CALL ER00
DISPLAY OUTPUT
COMPLETE
CP01


CP23
ADD 1 TO CPTE
CPTE 0
=
≠
CALL HM00
BACKSPACE
TAPE
CALL ER00
DISPLAY BAD
RECORD
CP03
CP01

CP00
PAGE 4


CPCA
SENSE WRITE BUFFER
=
≠
LOAD REGX 7
CLEAR AND INPUT CHAR
SET PARITY
SUBTRACT 0300 FROM CHAR
RETURN

3.3.5 CT00 Count

3.3.5.1 Purpose

CT00 is a subroutine whose purpose is to count the number of records whenever "COUNT" is specified as the answer to the "ACTION" query. The Subroutine will only count those records which meet the criteria specified in the response to the "WHAT" query.

3.3.5.2 Technical Description

The subroutine checks the What entry in the Request Table. If the entry is zero, the default value of "count all records" is assumed. If the entry is non-zero, only those records that meet the 'What' response criteria are counted. To determine if the record meets the 'What' response criteria, the subroutine Match What (MW00) is called to check all question/answer pairs in tape input buffer.

If the entry meets the specified criteria, the counter (CTCT) is incremented. When an End of File is encountered by the Control Program, CP00, control is given to the entry point CT10. The count is converted from binary to ASCII, displayed on the output device and the counter (CTCT) cleared to zero. Control is then returned to CP00.

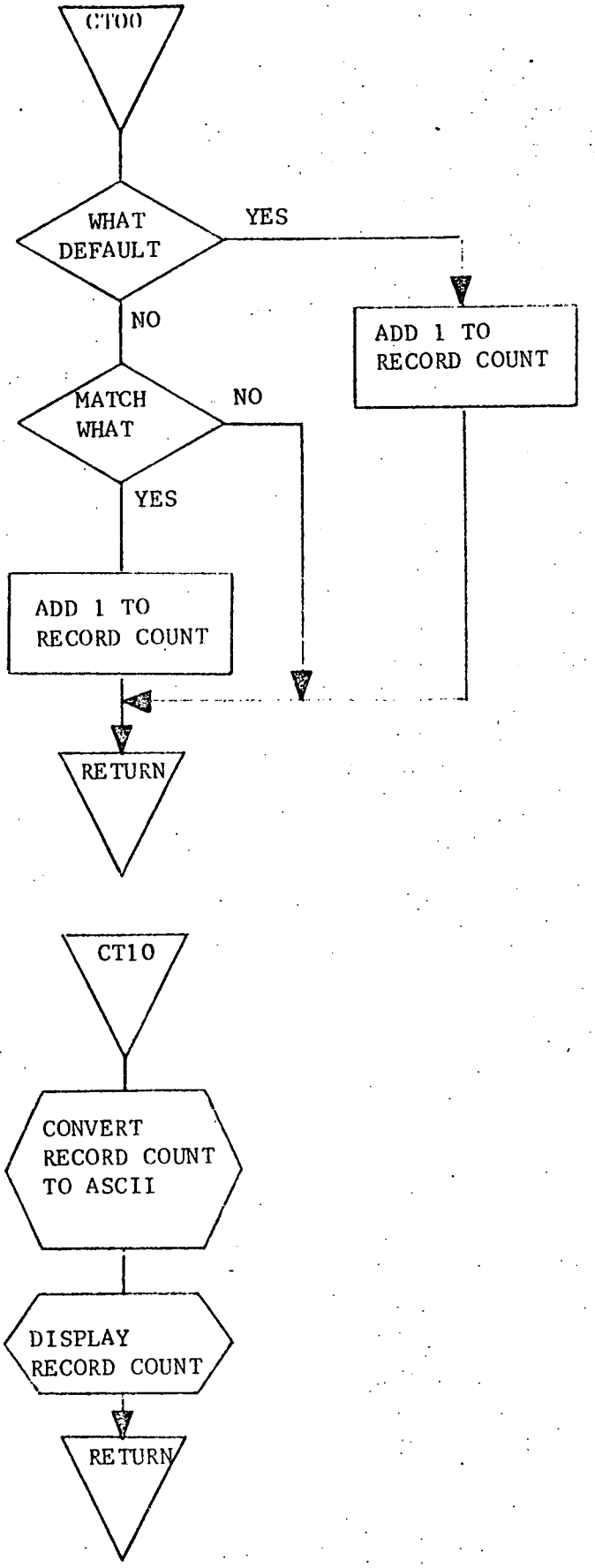
3.3.5.2.1 Calling Sequence

CALL CT00

CALL CT10

REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	N/A	Modified
B	N/A	Modified
X	N/A	Modified
Overflow	N/A	Modified

3.3.5.2.2 General Flow Chart



3.3.5.3 Label Description

3.3.5.3.1 Local

CTMS Message Display 'Count Is'

CTNO Four Work Areas used to convert the count to ASCII

CTOC Display Count

CTQN Question number to be checked by Match What

CTST Status Word

3.3.5.3.2 Global

CTCT Binary Count used also by CY00

3.3.5.3.3 Entry Points

CT00 Count the Records

CT10 Output the Count

3.3.5.3.4 External References

CPRT Defined in Appendix B, Request Table

CPTB Defined in Appendix A, Tape Buffer. Second word in buffer contains number of questions in buffer

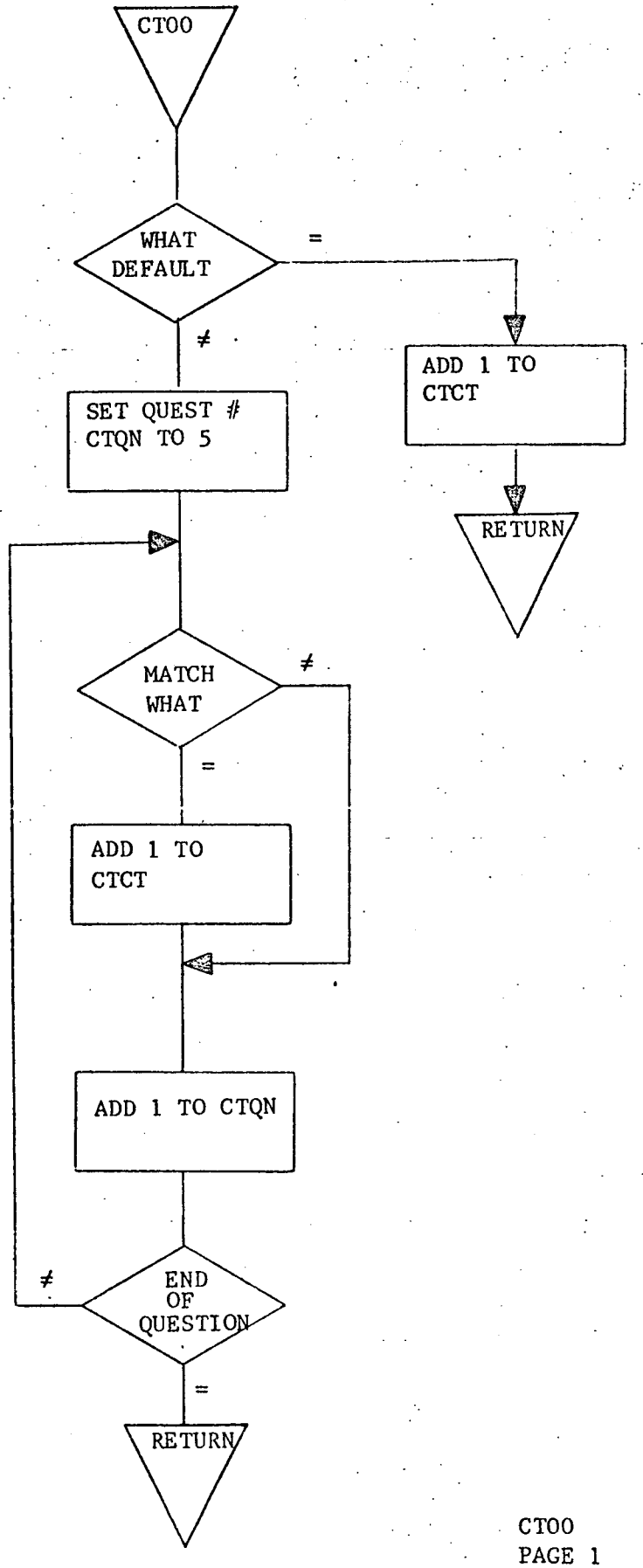
MW00 Subroutine Match What

OM00 Subroutine to output count to User Terminate

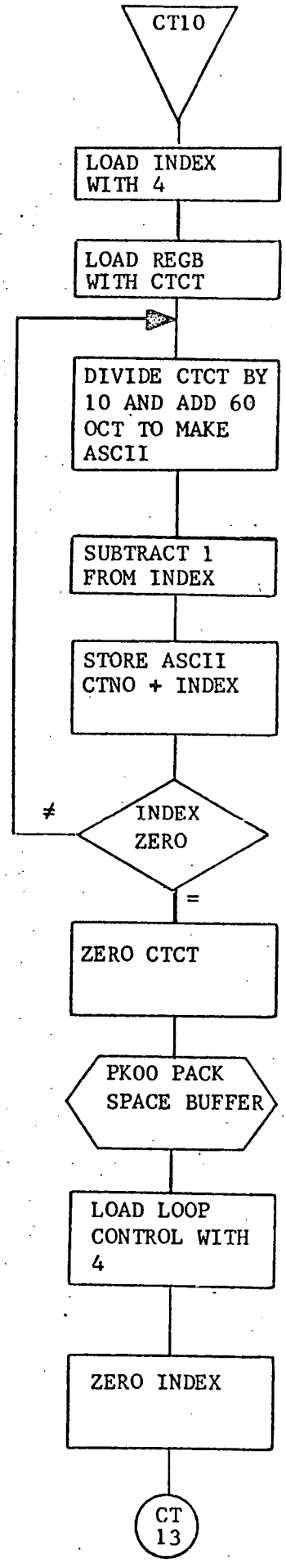
PK00 Subroutine to Initialization Pack Output Count

PK01 Subroutine to Pack Count

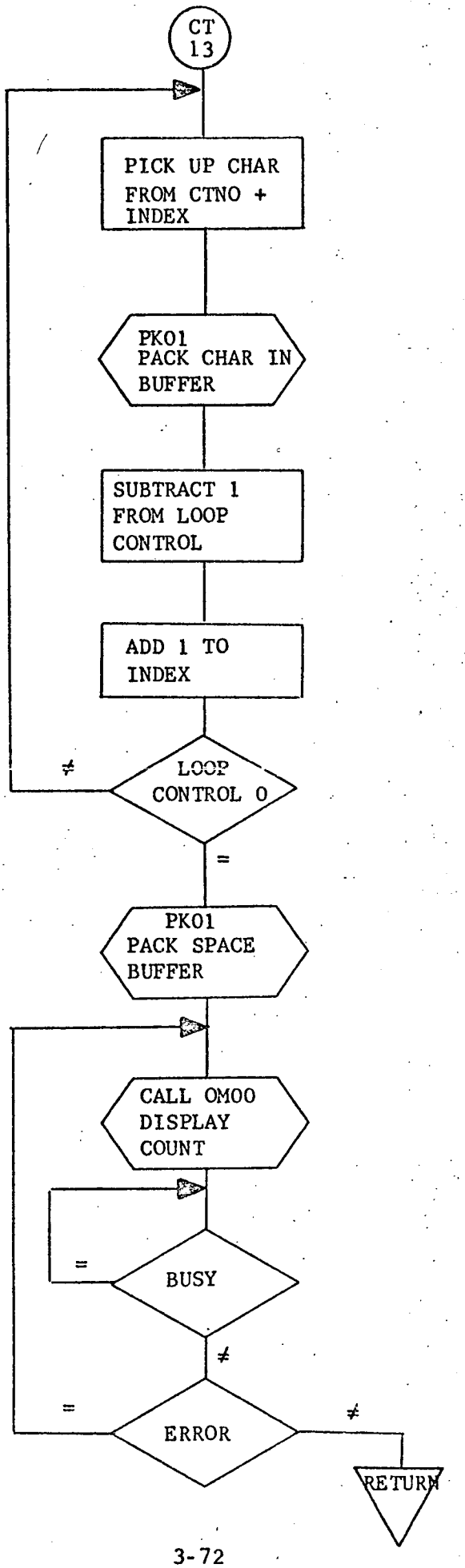
3.3.5.4 Detailed Flow Chart



CTOO
PAGE 1


CT10
LOAD INDEX WITH 4
LOAD REGB WITH CTCT
DIVIDE CTCT BY 10 AND ADD 60 OCT TO MAKE ASCII
SUBTRACT 1 FROM INDEX
STORE ASCII CTNO + INDEX
≠
INDEX ZERO
=
ZERO CTCT
PK00 PACK SPACE BUFFER
LOAD LOOP CONTROL WITH 4
ZERO INDEX
CT 13

CT00
PAGE 2


CT
13
PICK UP CHAR
FROM CTNO +
INDEX
PK01
PACK CHAR IN
BUFFER
SUBTRACT 1
FROM LOOP
CONTROL
ADD 1 TO
INDEX
≠
LOOP
CONTROL 0
=
PK01
PACK SPACE
BUFFER
CALL OM00
DISPLAY
COUNT
=
BUSY
≠
=
ERROR
≠
RETURN

CT00
PAGE 3

3.3.6 CY00 - COPY Data

3.3.6.1 Purpose

Copy is a subroutine whose purpose is to copy data from the input file whenever "COPY" is specified as the response to "ACTION" query.

3.3.6.2 Technical Description

The Copy Subroutine initializes the output unit number based on the current assignment of the input unit number. A message to the computer operator requesting that a tape be mounted is generated. The computer operator responds with a 'G' when the tape is mounted. The tape mount message is repeated until the operator responds with a 'G'; subject to a maximum repetition of fifty times in which case a message, 'NO RESPONSE FROM COMPUTER OPERATOR, REQUEST CANCELLED', is displayed at the user terminal.

After the computer operator responds, the first record is written and the counter (CTCT) is set to one. Thereafter each time CY00 is entered, the record just read by the control program (CP00) is written to the output tape and the counter (CTCT) incremented.

When an End of File is encountered by CP00, control is given to CY20. CY20 writes a software End of File and hardware End of File. The output count CTCT is displayed to the user terminal and the computer operator is requested to dismount the tape. Control is returned to the control program.

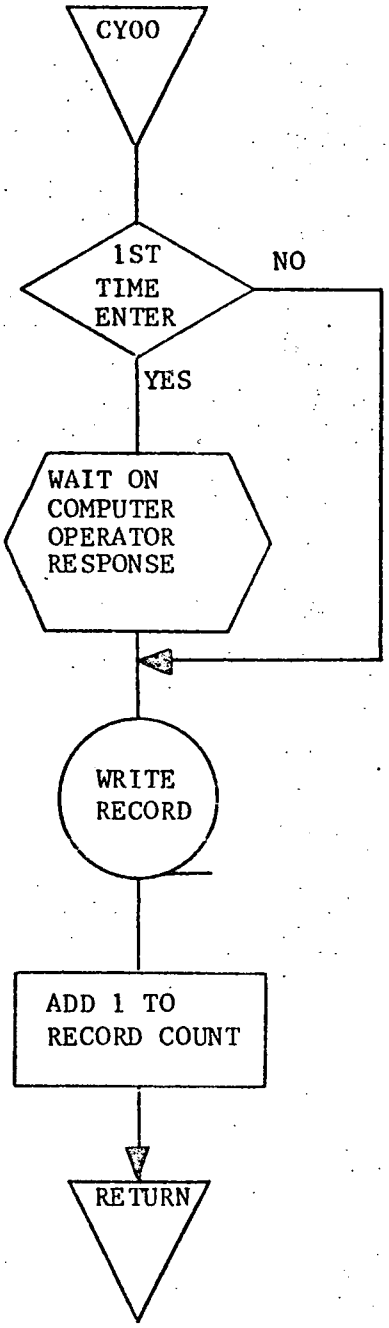
3.3.6.2.1 Calling Sequence

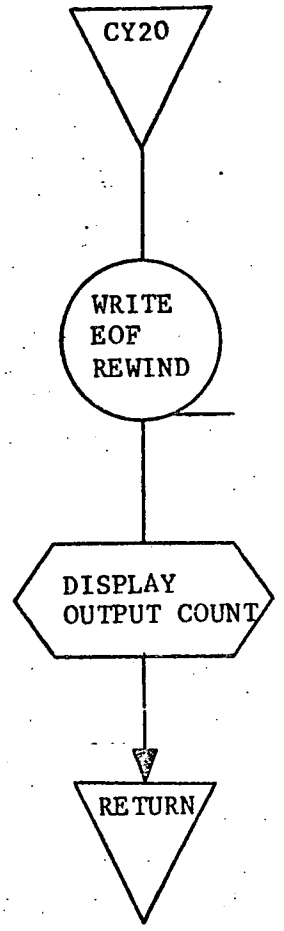
```
CALL    CY00

CALL    CY20
```

REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	N/A	Modified
B	N/A	Modified
X	N/A	Modified
Overflow	N/A	Modified

3.3.6.2.2 General Flow Chart




CY20
WRITE
EOF
REWIND
DISPLAY
OUTPUT COUNT
RETURN

3.3.6.3.2 Global

None

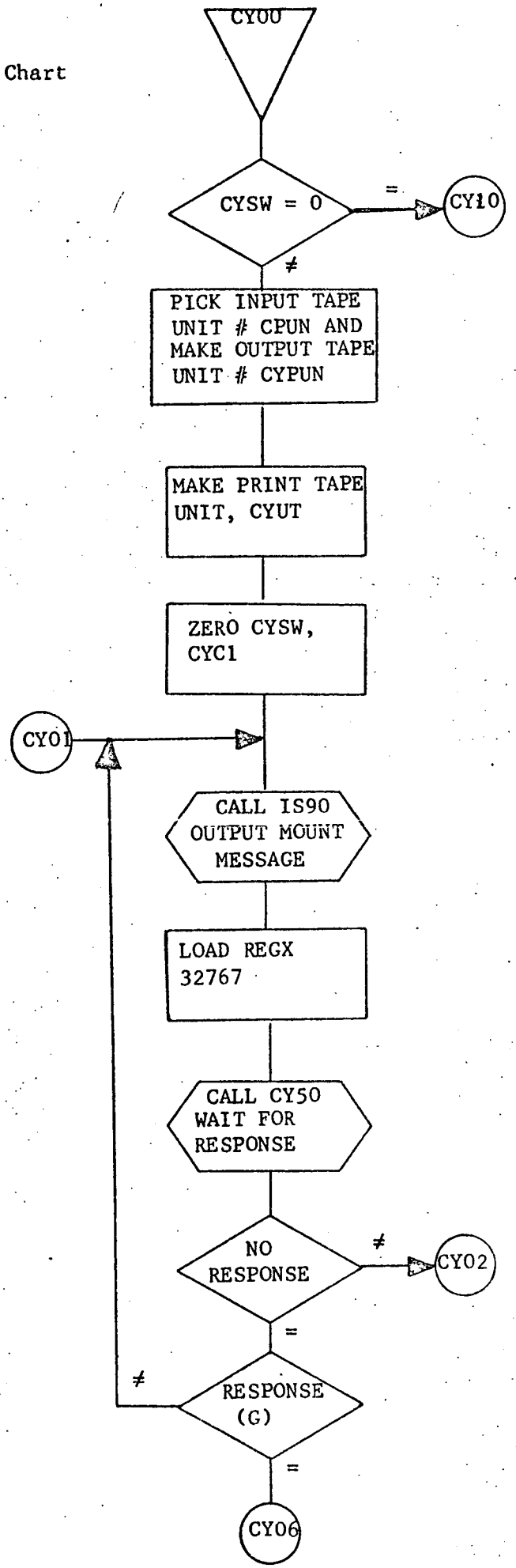
3.3.6.3.3 Entry Points

CY00	COPY TAPE
CY20	WRITE END OF FILE

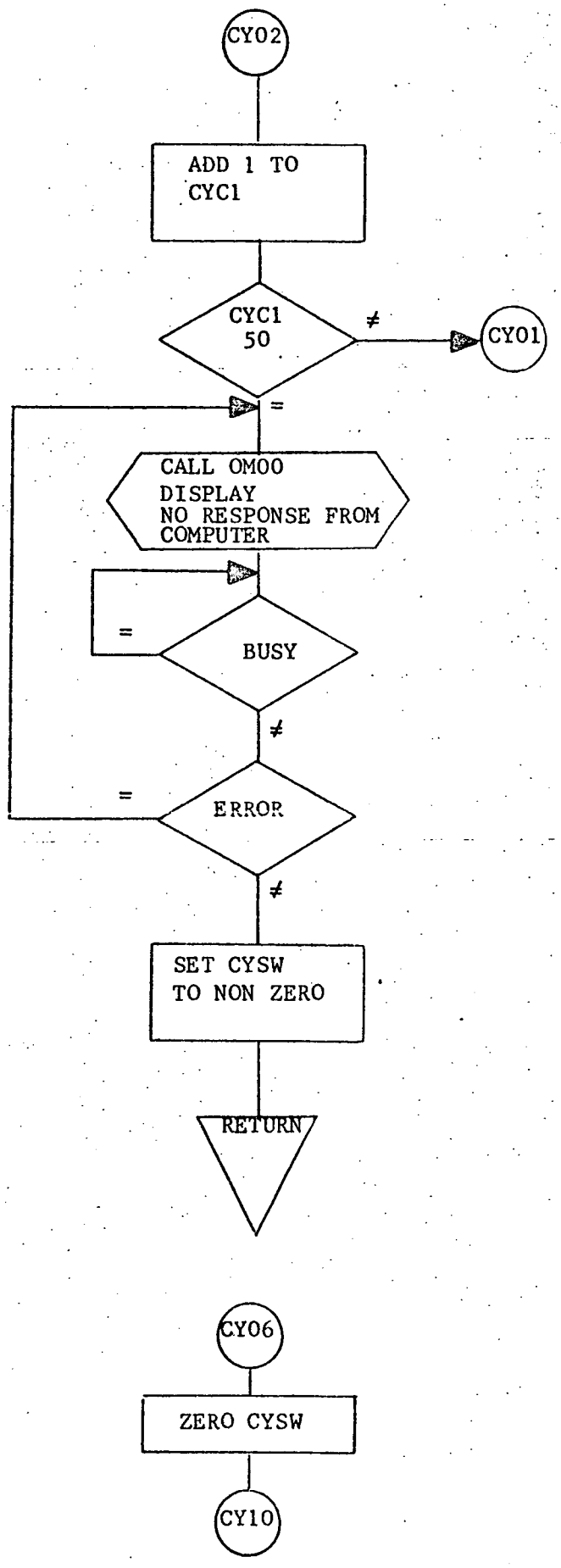
3.3.6.3.4 External References

CPCA	Subroutine to check for abort
CPTB	Defined in Appendix A Tape Buffer
CPTS	Defined in CP00; number of characters to be written
CP20	Transfer control when abort
CTCT	Defined in CT00, counter
CT10	Subroutine to output count to user
HM00	Subroutine to write to tape
IS90	Subroutine to output message to computer operator
OM00	Subroutine to output message to user

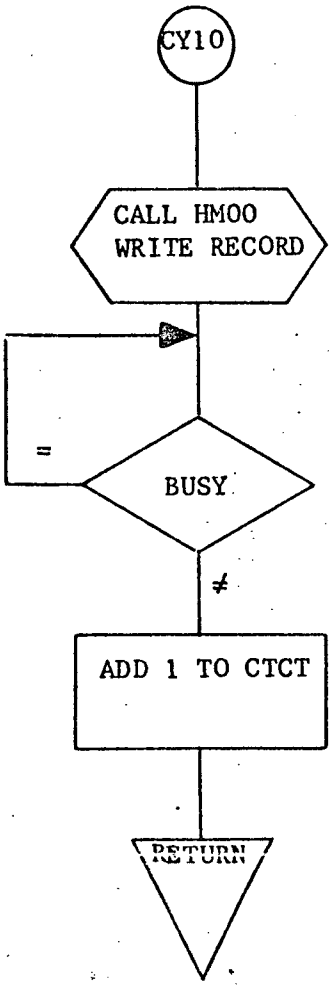
3.3.6.4 Detailed Flow Chart

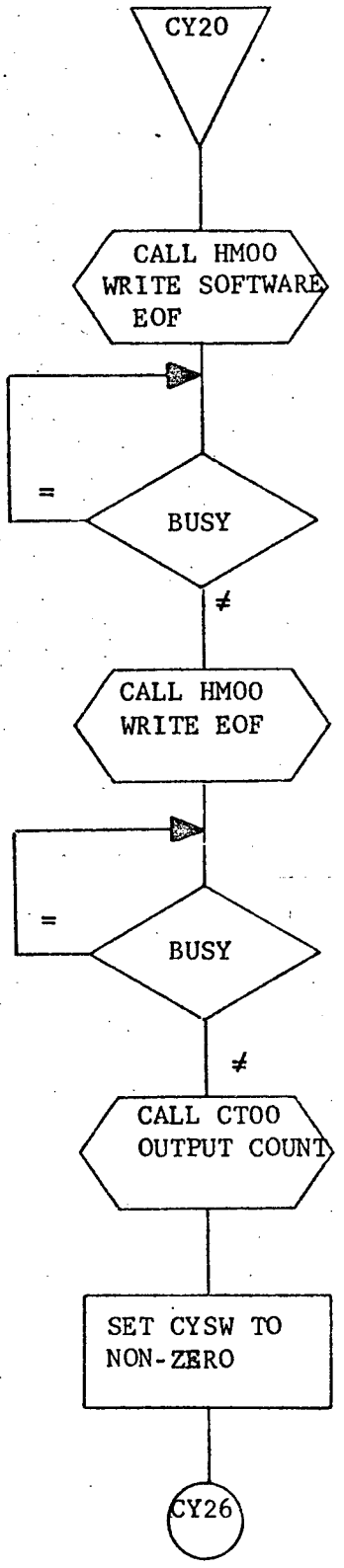


CY00
PAGE 1

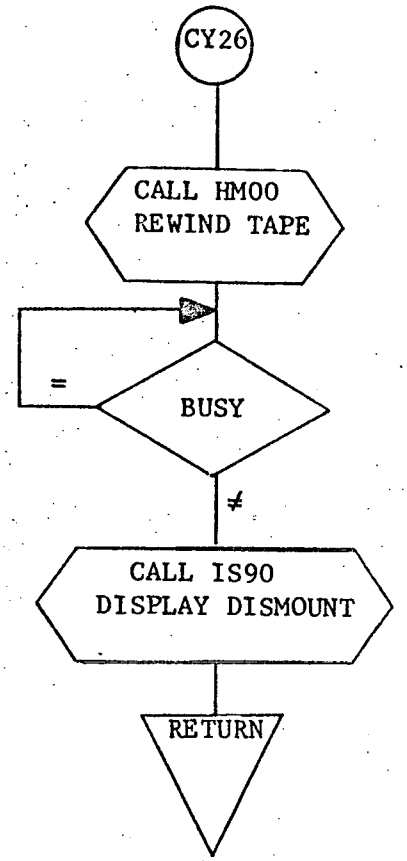

CY02
ADD 1 TO
CYC1
CYC1
50
≠
CY01
=
CALL OM00
DISPLAY
NO RESPONSE FROM
COMPUTER
=
BUSY
≠
=
ERROR
≠
SET CYSW
TO NON ZERO
RETURN
CY06
ZERO CYSW
CY10

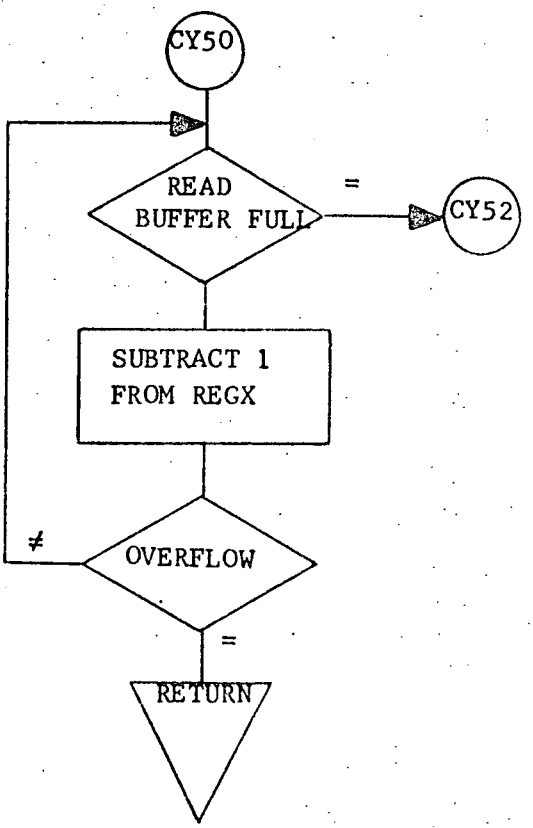
CY00
PAGE 2

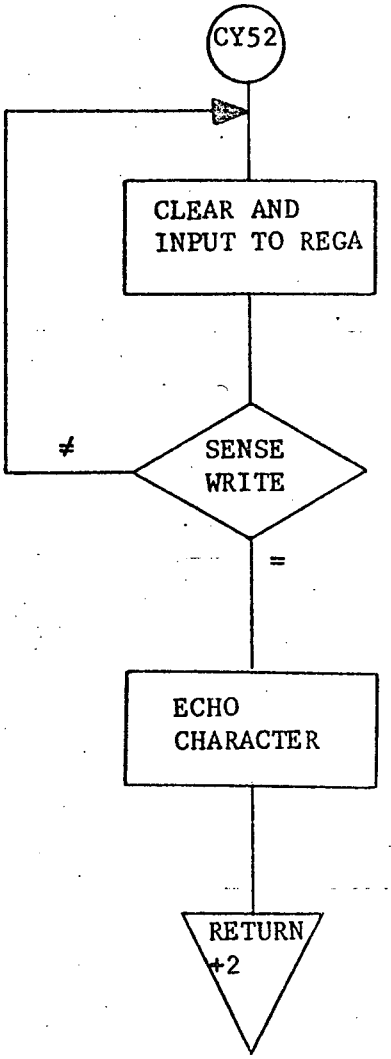

CY10
CALL HM00
WRITE RECORD
=
BUSY
≠
ADD 1 TO CTCT
RETURN


CY20
CALL HM00
WRITE SOFTWARE
EOF
=
BUSY
≠
CALL HM00
WRITE EOF
=
BUSY
≠
CALL CT00
OUTPUT COUNT
SET CYSW TO
NON-ZERO
CY26

CY00
PAGE 3


CY26
CALL HM00
REWIND TAPE
=
BUSY
≠
CALL IS90
DISPLAY DISMOUNT
RETURN


CY50
READ
BUFFER FULL
=
CY52
SUBTRACT 1
FROM REGX
≠
OVERFLOW
=
RETURN


CY52
CLEAR AND
INPUT TO REGA
SENSE
WRITE
≠
=
ECHO
CHARACTER
RETURN
+2

3.3.7 ER00 - Output Message

3.3.7.1 Purpose

ER00 is a subroutine whose purpose is to output error or advisory messages to the user at the terminal.

3.3.7.2 Technical Description

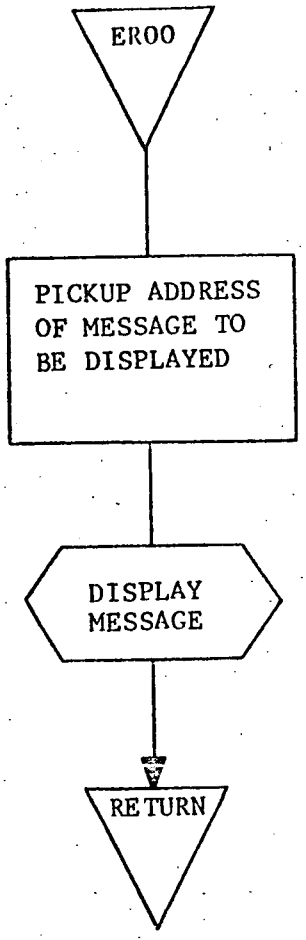
Whenever an error occurs or status information is to be output, subroutine ER00 is employed to select the proper message from table ERTB and output it. Register X is used as an index into ERTB to indicate the message desired to be output. The address of the start of the message is retrieved and stored in the call to OM00, which outputs the message.

3.3.7.2.1 Calling Sequence

CALL ER00

REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	N/A	Modified
B	N/A	Same
X	Number of Message to be displayed	Modified
Overflow	N/A	Same

3.3.7.2.2 General Flow Chart



3.3.7.3 Label Description

3.3.7.3.1 Local

ERCT contains 24 for number of characters to be output.

ERTB is the table of address for messages. The table has 20 entries. Each entry specifies the address of the first character of the message.

ERR0 'INVALID SS NO'

ERR1 'INVALID RECORD'

ERR2 'INVALID TYPE'

ERR3 'INVALID DATA'

ERR4 'INVALID CONDITION'

ERR5 'INVALID ACTION'

ERR6 'INVALID WHAT'

ERR7 'CANNOT ANALYZE PROSE'

ER08 'ILLEGAL PARENTHESIS'

ER11 'RECORD BAD-SKIPPED'

ER12 'NO ANSWER WITH COLON'

ER13 'TOO MANY PARAMETERS'

ER14 'INVALID WHAT'

ER15 'POWER FAILURE, PLEASE'

ER16 'RESTART REQUEST*******'

ER17 'RETRIEVAL WORKING'

ER18 'RETRIEVAL ABORTED'

ER19 'OUTPUT TERMINATED'

3.3.7.3.2 Global

None

3.3.7.3.3 Entry Point

ER00

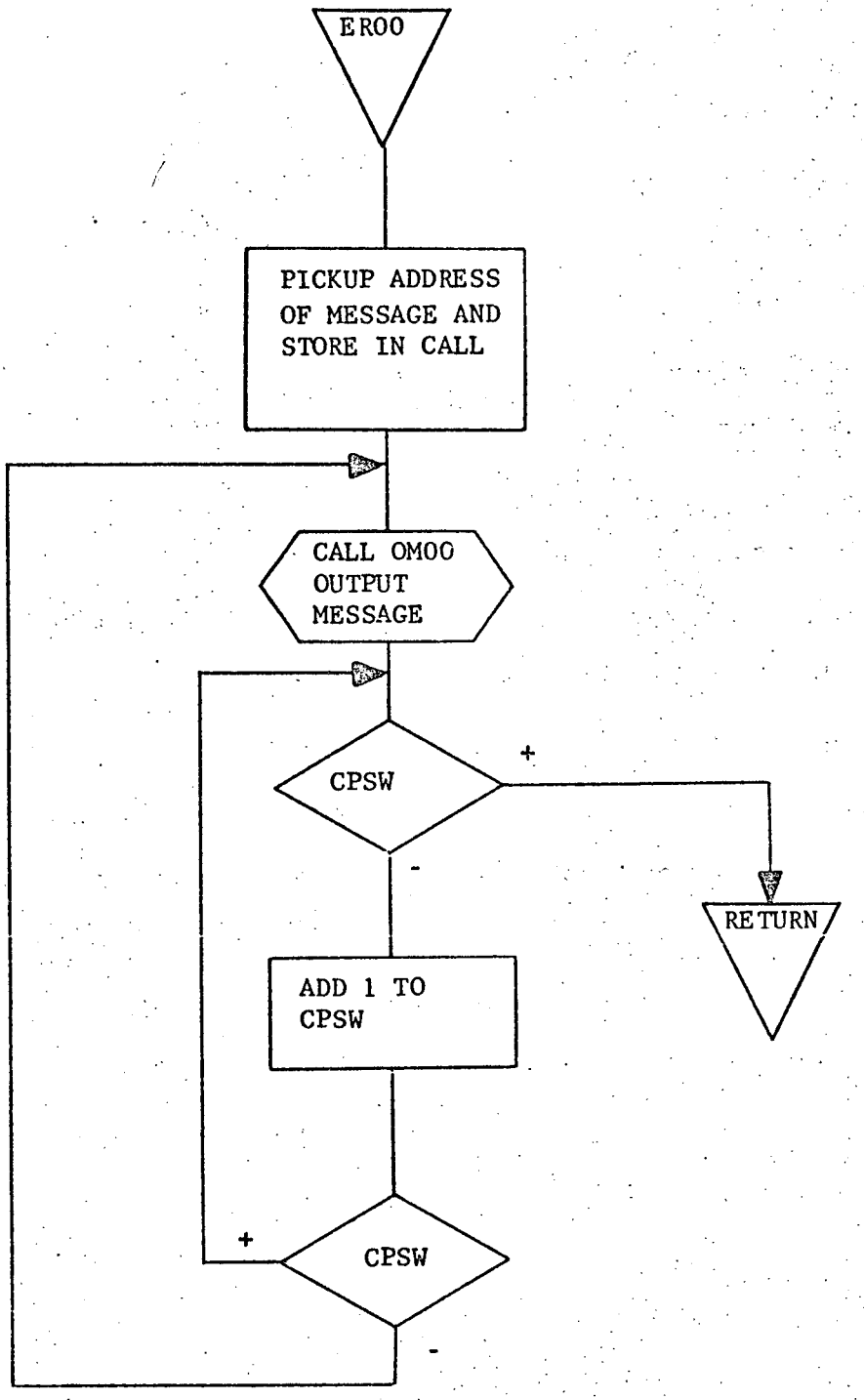
3.3.7.3.4 External References

CP0C is output message in CP00 'OUTPUT COMPLETE'

CPET is output message in CP00 'TAPE ERROR RECORD SKIP'

OM00 call to output the message.

3.3.7.4 Detailed Flow Chart



ER00
PAGE 1

3.3.8 FA00 - FLOATING POINT - ASCII Conversion

3.3.8.1 Purpose

The purpose of the subroutine FA00 is to translate a floating point number from its internal representation to alpha codes into a buffer for subsequent printout.

3.3.8.2 Technical Description

The overall approach used to encode the floating point number utilizes the Varian-provided subroutine ($HS) which converts floating point numbers to binary integers. $HS is obviously subject to the limitation of 32,767; i.e., the maximum integer that may be represented in the 620i. The maximum number of characters permitted to be encoded excluding the decimal point is 7.

The integer part and fractional part of the floating point number are encoded separately. The integer part of the number to be encoded is compared with the upper limit of 32,767; should it exceed the maximum, it is divided by 1,000, resulting in a quotient equal to the n significant digits greater than 1,000. The resulting floating point integer is converted to binary integer via $HS. The resulting binary integer is then encoded to a string of ASCII characters. The integer part of the number which is less than 1,000 is then converted to a binary integer via $HS and subsequently converted to its ASCII equivalent.

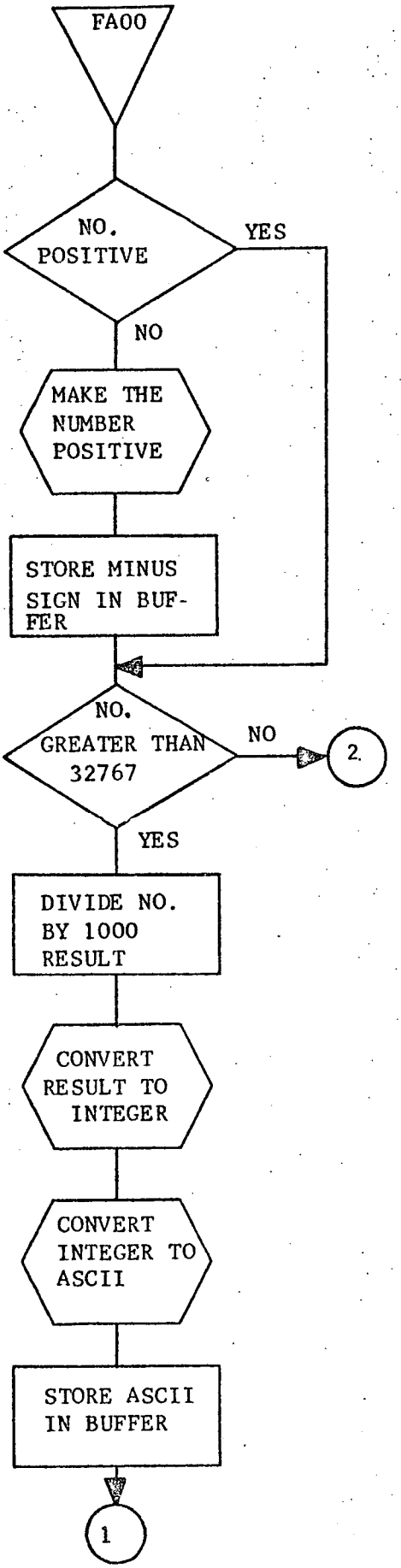
If a fractional part exists, the decimal point is inserted and the fractional part is multiplied by 10,000 to make it an integer. The conversion process used for the integer part is then utilized for the fractional part also. A second multiplication by 10,000 of the remaining portion of the fractional number may be necessary to acquire the remaining digits.

3.3.8.2.1 Calling Sequence

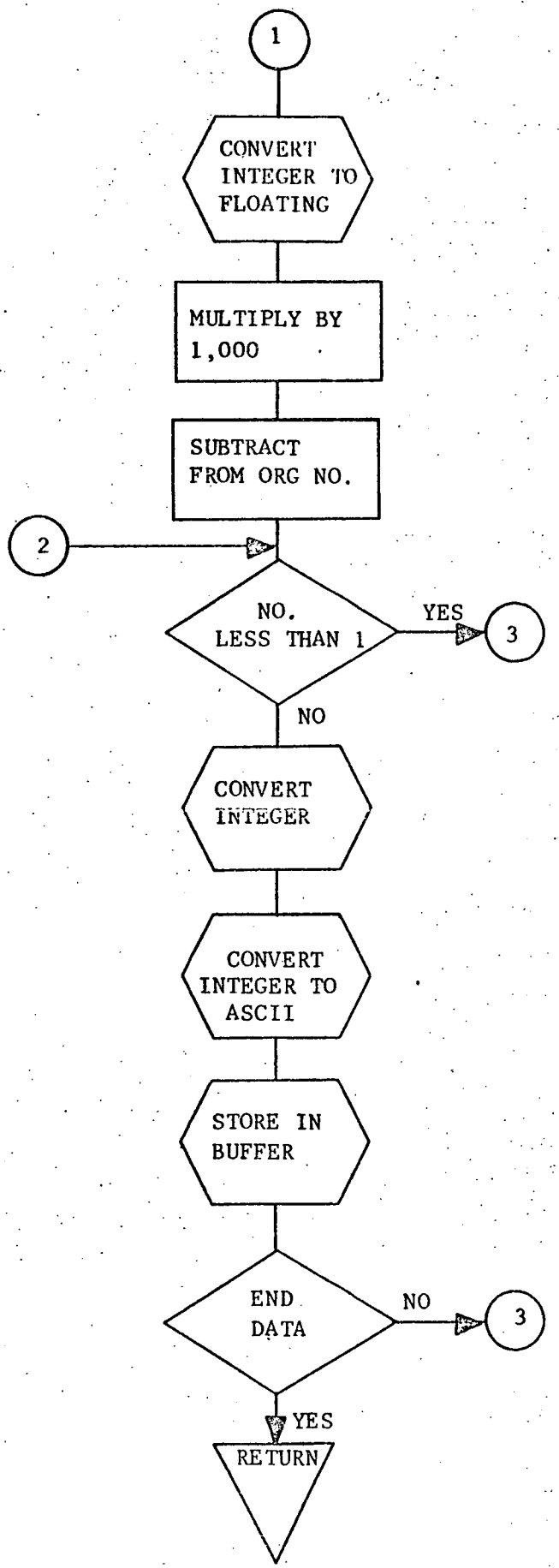
CALL FA00

REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	Most signification part of number to be converted.	Modified
B	Least significant part of number to be converted.	Modified
X	Address when to store result.	Modified
Overflow	N/A	Modified

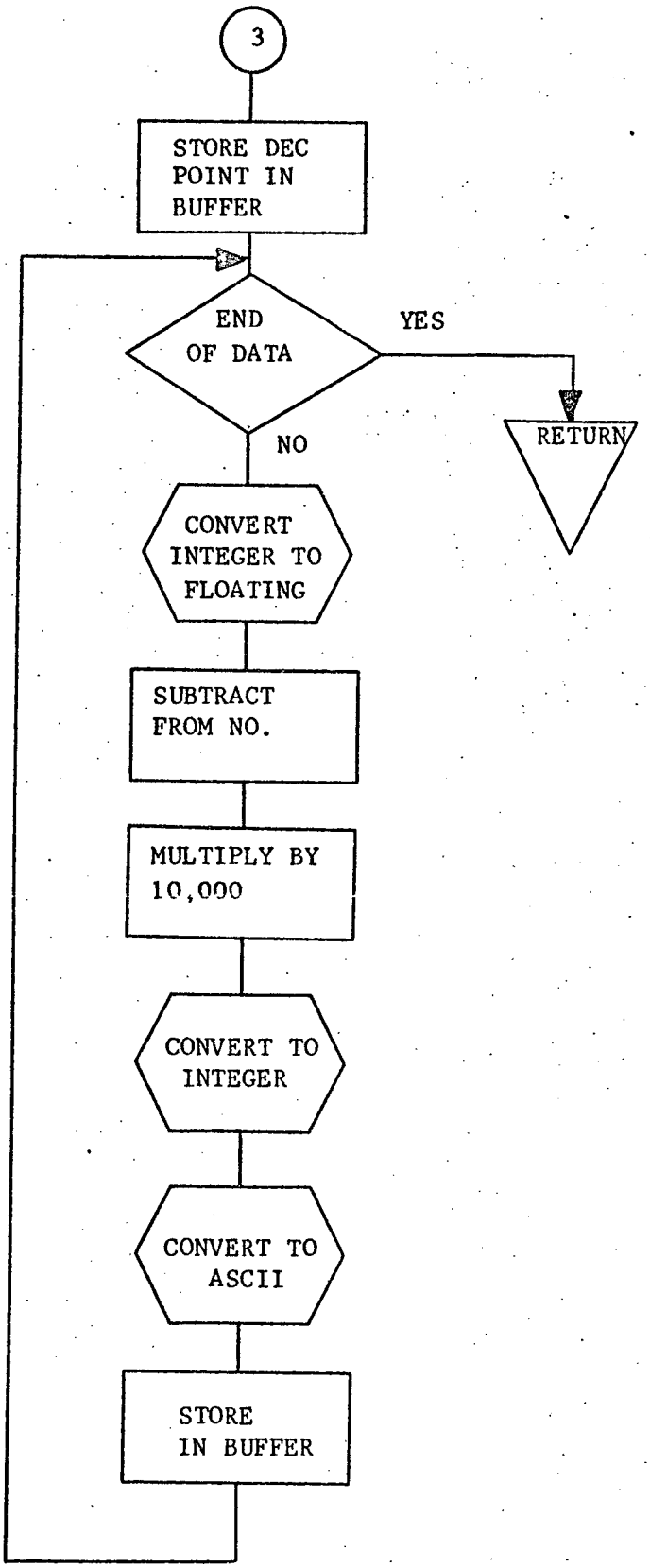
3.3.8.2.2 General Flow Chart



FA00


1
CONVERT INTEGER TO FLOATING
MULTIPLY BY 1,000
SUBTRACT FROM ORG NO.
2
NO. LESS THAN 1
YES
3
NO
CONVERT INTEGER
CONVERT INTEGER TO ASCII
STORE IN BUFFER
END DATA
NO
3
YES
RETURN

FA00


3
STORE DEC POINT IN BUFFER
END OF DATA
YES
RETURN
NO
CONVERT INTEGER TO FLOATING
SUBTRACT FROM NO.
MULTIPLY BY 10,000
CONVERT TO INTEGER
CONVERT TO ASCII
STORE IN BUFFER

3.3.8.3 Label Description

3.3.8.3.1 Local

FABF Binary working storage used to convert integer

FACT Counter

FADG Digit counter

FADX Address of buffer to store result

FAH1 Working storage for high order floating point number

FAH2 Working storage for low order floating point number

FAMX Floating Point number 32,767.0

FAON Floating Point number 1.0

FARA Most significant part of number to be converted

FARB Least significant part of number to be converted

FARD Floating Point number $.5 \times 10^{-7}$

FATH Floating Point number 1000.0

FATN Floating Point number 10,000.0

FATP 5 word working storage used to convert to ASCII code

FASW Switch used to tell if a leading zero is present

3.3.8.3.2 Global

None

3.3.8.3.3 Entry Points

FAOO

3.3.8.3.4 External References

PKOO Subroutine entry point to pack first character in output buffer.

PKO1 Subroutine entry point to pack character in output buffer.

SIGN Subroutine to copy sign.

$HS Subroutine to convert floating point number to binary integer.

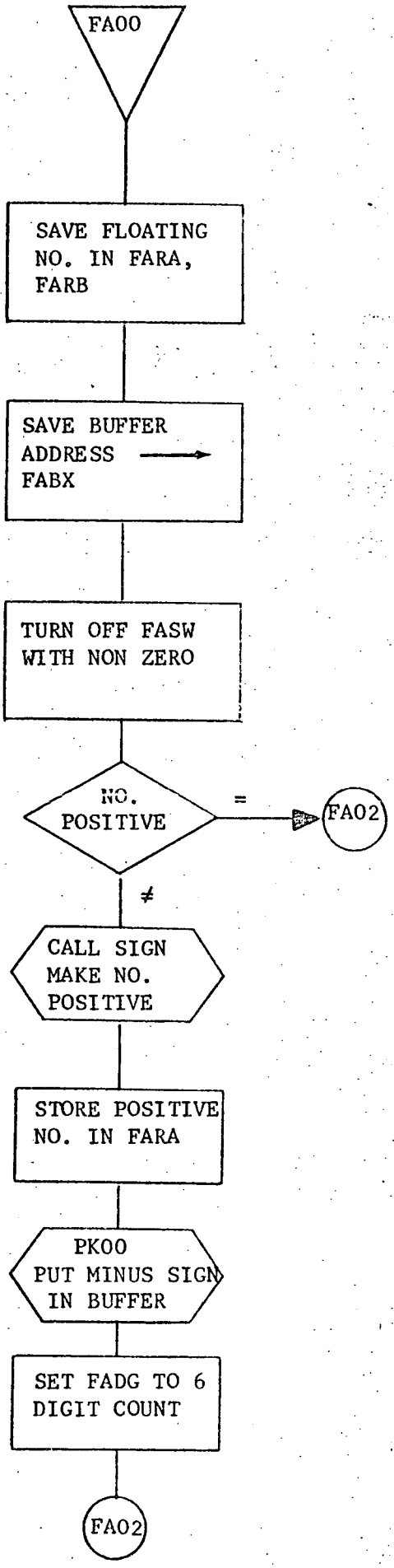
$QL Subroutine to perform floating point subtraction.

$QM Subroutine to perform floating point multiply.

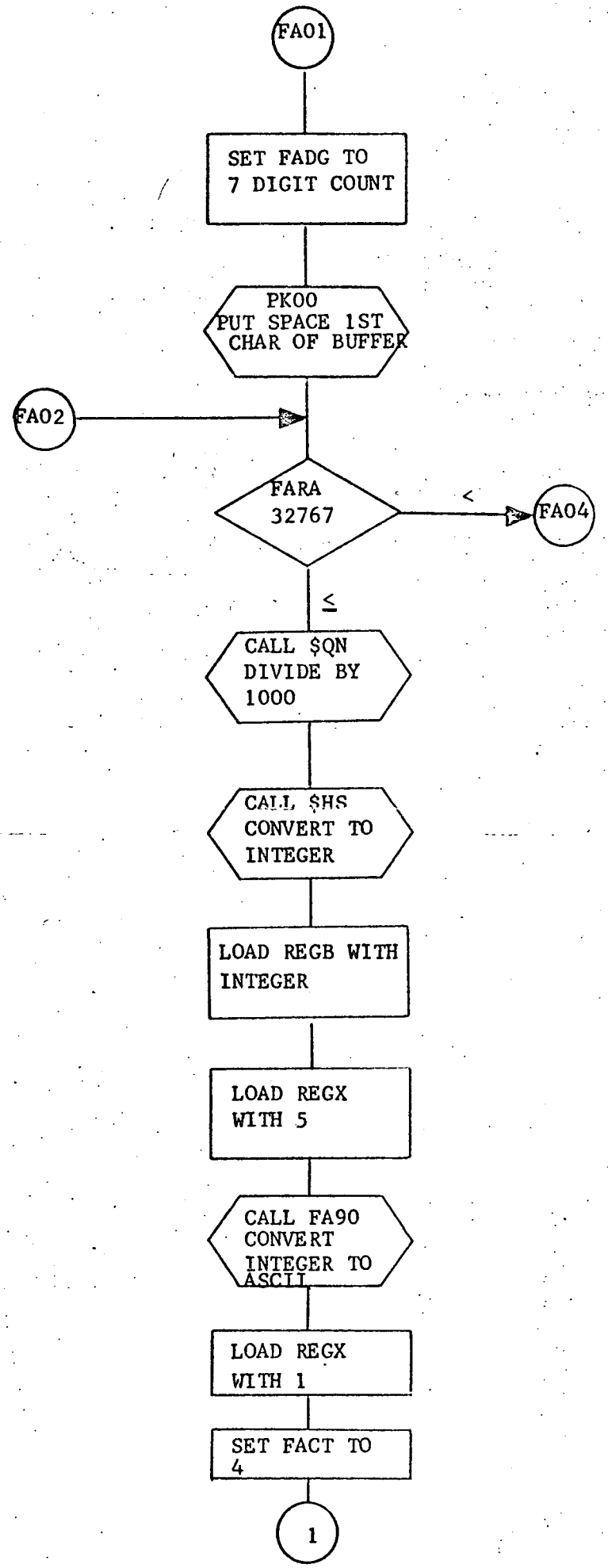
$QN Subroutine to perform floating point divide.

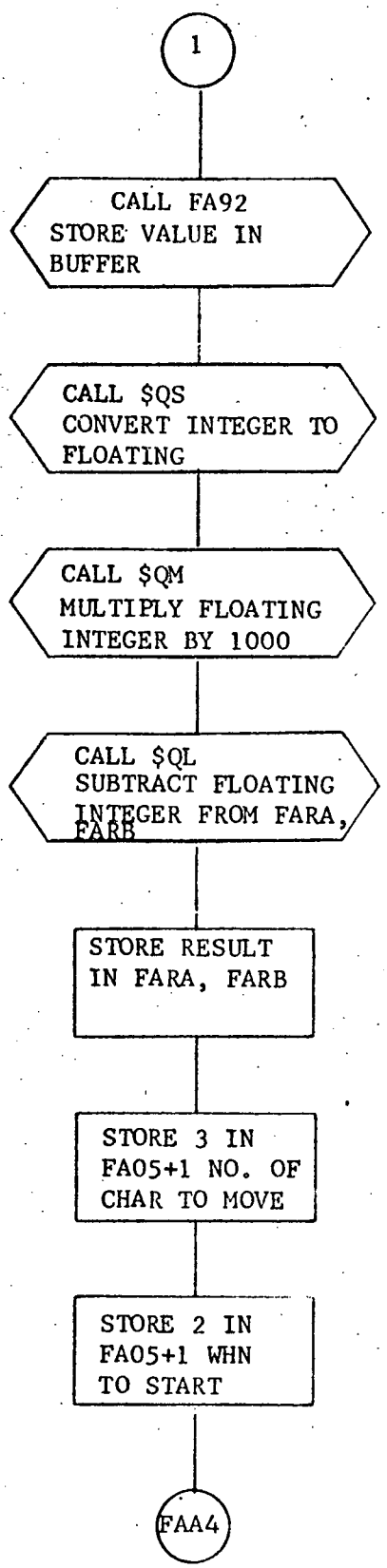
$QS Subroutine to convert binary integer to floating point number.

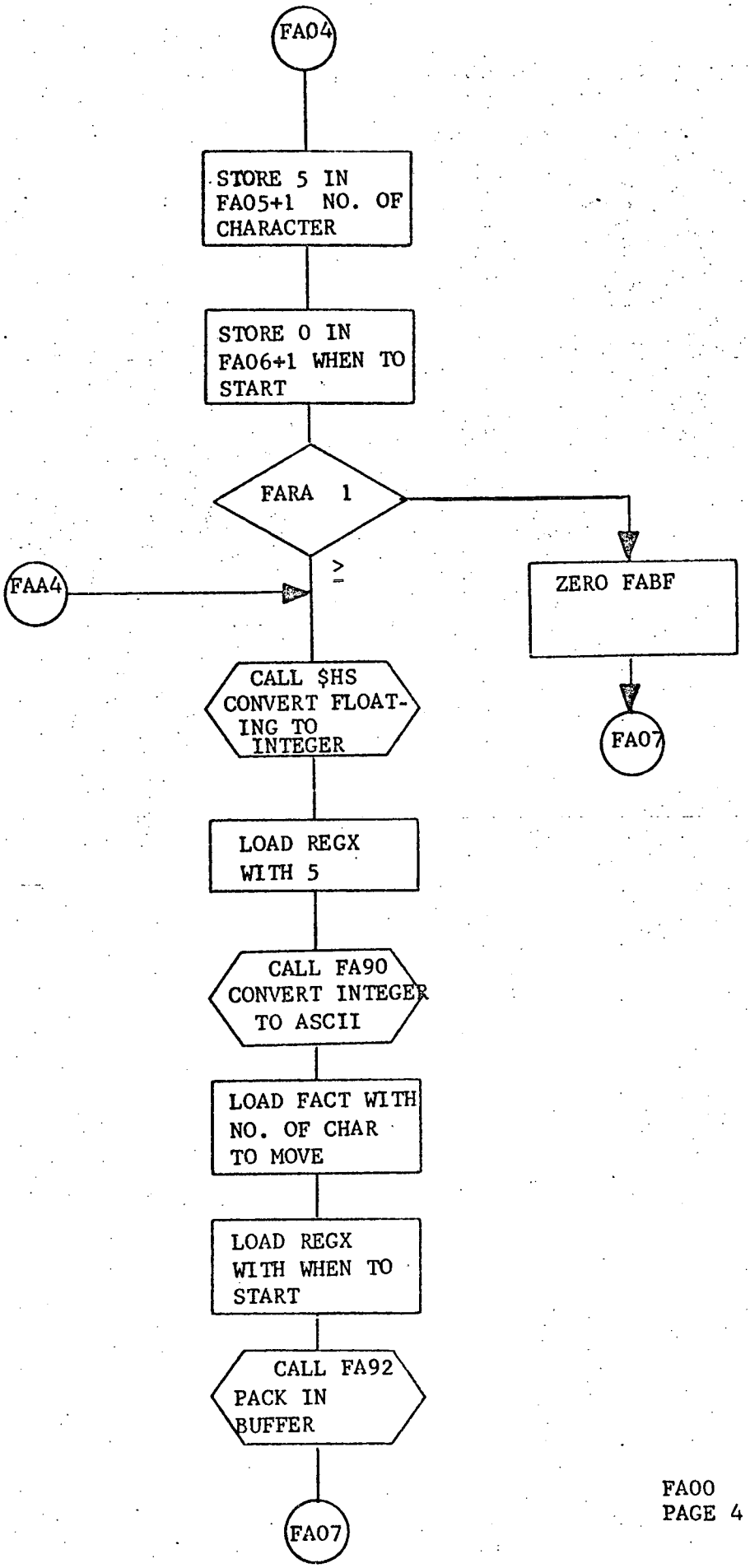
3.3.8.4 Detailed Flow Chart



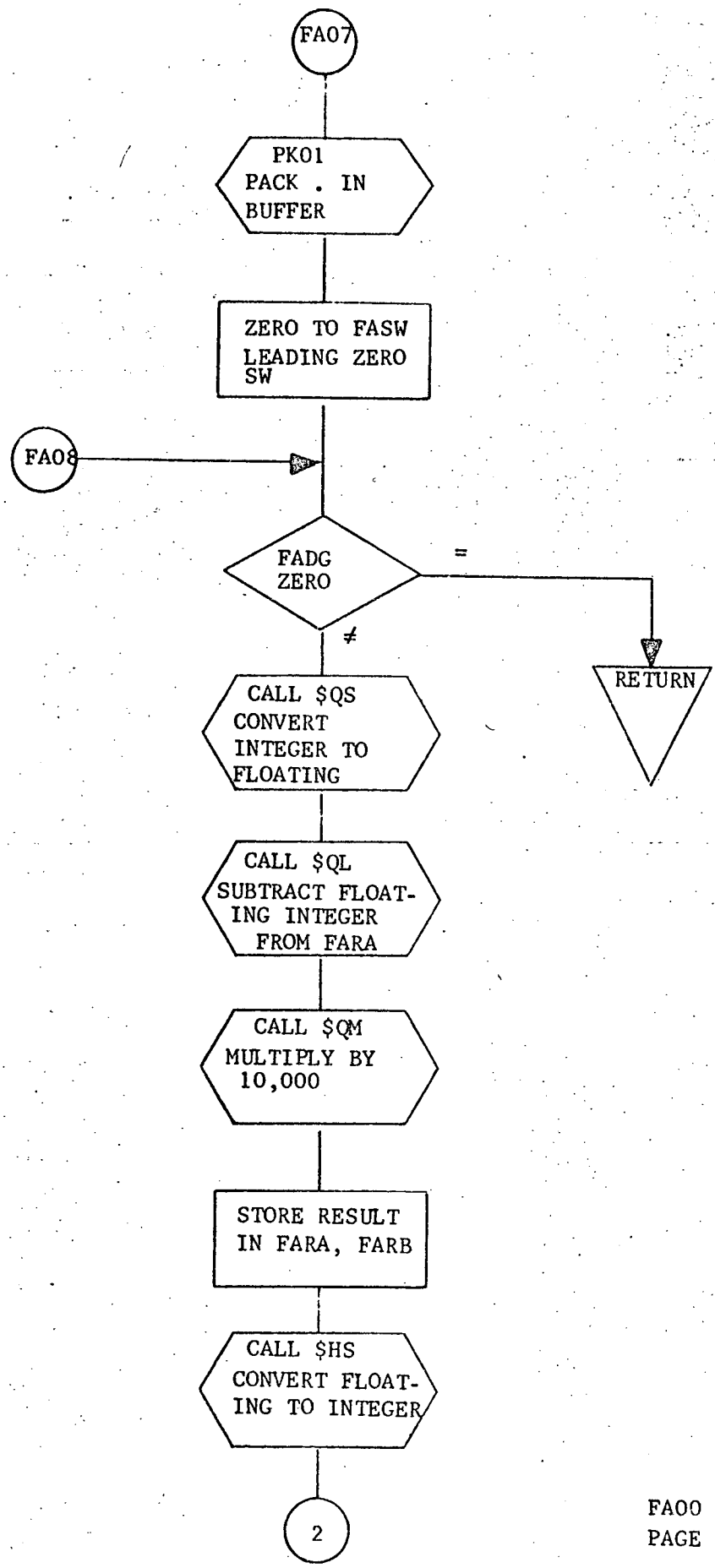
FA00
PAGE 1


FA01
SET FADG TO 7 DIGIT COUNT
PK00 PUT SPACE 1ST CHAR OF BUFFER
FA02
FARA 32767
<
FA04
≤
CALL $QN DIVIDE BY 1000
CALL $HS CONVERT TO INTEGER
LOAD REGB WITH INTEGER
LOAD REGX WITH 5
CALL FA90 CONVERT INTEGER TO ASCII
LOAD REGX WITH 1
SET FACT TO 4
1

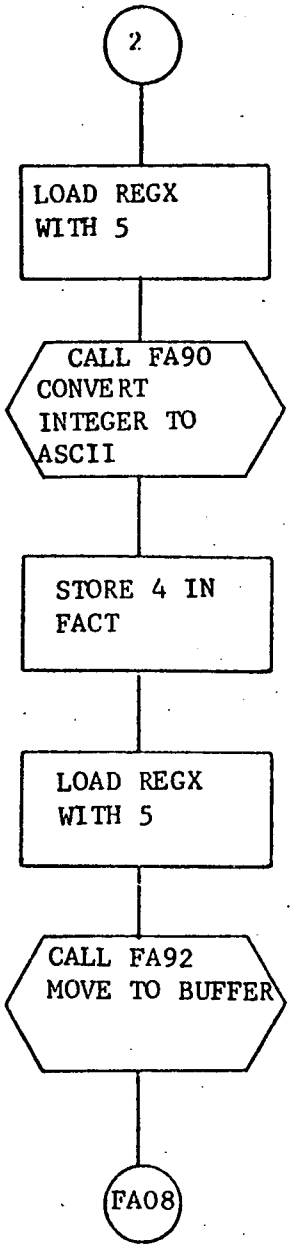

1
CALL FA92
STORE VALUE IN
BUFFER
CALL $QS
CONVERT INTEGER TO
FLOATING
CALL $QM
MULTIPLY FLOATING
INTEGER BY 1000
CALL $QL
SUBTRACT FLOATING
INTEGER FROM FARA,
FARB
STORE RESULT
IN FARA, FARB
STORE 3 IN
FA05+1 NO. OF
CHAR TO MOVE
STORE 2 IN
FA05+1 WHN
TO START
FAA4

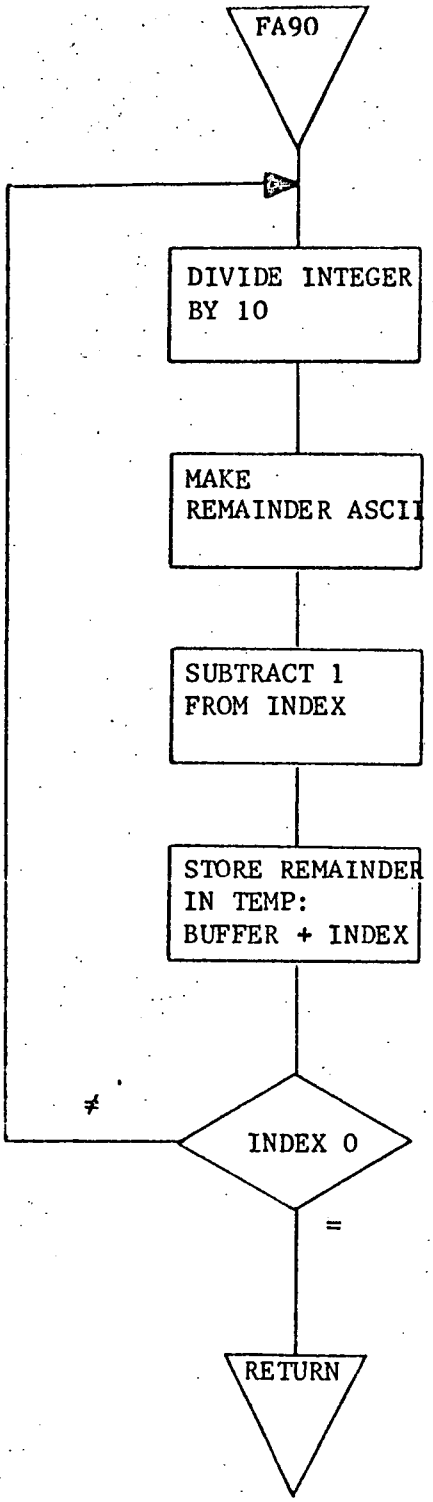

FA04
STORE 5 IN FA05+1 NO. OF CHARACTER
STORE 0 IN FA06+1 WHEN TO START
FARA 1
>=
FAA4
ZERO FABF
FA07
CALL $HS CONVERT FLOAT-ING TO INTEGER
LOAD REGX WITH 5
CALL FA90 CONVERT INTEGER TO ASCII
LOAD FACT WITH NO. OF CHAR TO MOVE
LOAD REGX WITH WHEN TO START
CALL FA92 PACK IN BUFFER
FA07

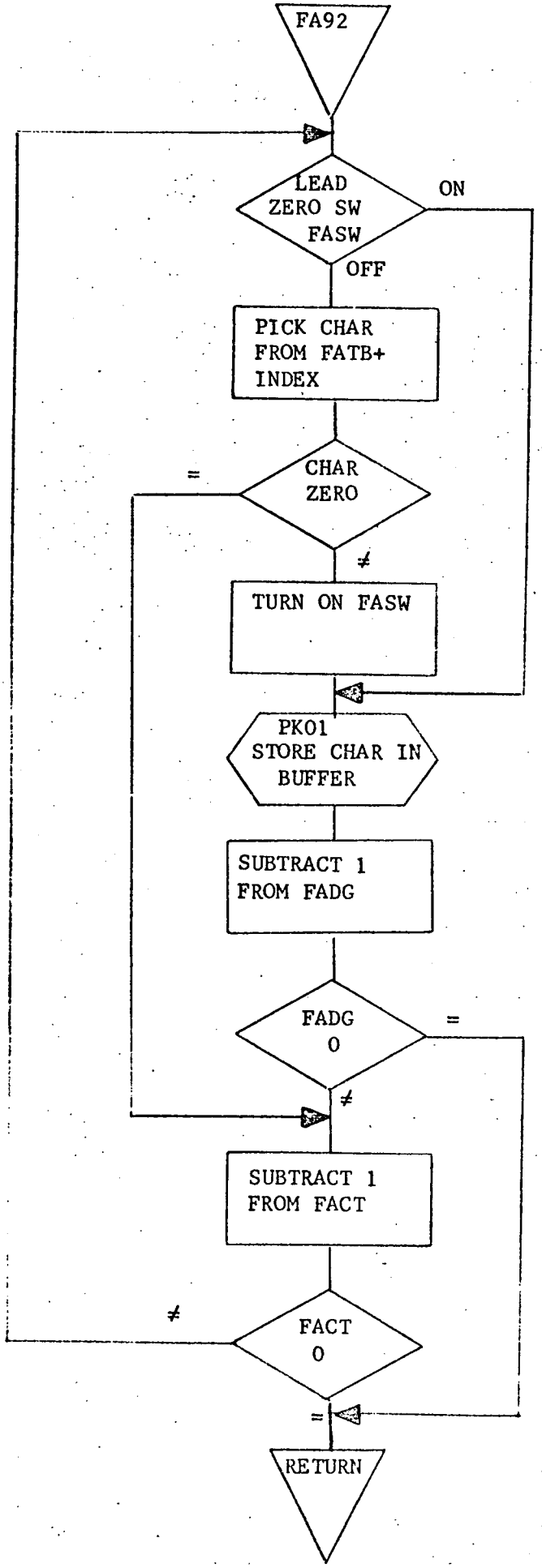
FA00
PAGE 4


FA07
PK01
PACK . IN
BUFFER
ZERO TO FASW
LEADING ZERO
SW
FA08
FADG
ZERO
=
≠
RETURN
CALL $QS
CONVERT
INTEGER TO
FLOATING
CALL $QL
SUBTRACT FLOAT-
ING INTEGER
FROM FARA
CALL $QM
MULTIPLY BY
10,000
STORE RESULT
IN FARA, FARB
CALL $HS
CONVERT FLOAT-
ING TO INTEGER
2

FA00
PAGE 5


2
LOAD REGX
WITH 5
CALL FA90
CONVERT
INTEGER TO
ASCII
STORE 4 IN
FACT
LOAD REGX
WITH 5
CALL FA92
MOVE TO BUFFER
FA08


FA90
DIVIDE INTEGER
BY 10
MAKE
REMAINDER ASCII
SUBTRACT 1
FROM INDEX
STORE REMAINDER
IN TEMP:
BUFFER + INDEX
INDEX 0
≠
=
RETURN


FA92
LEAD ZERO SW FASW
ON
OFF
PICK CHAR FROM FATB+ INDEX
CHAR ZERO
=
≠
TURN ON FASW
PK01 STORE CHAR IN BUFFER
SUBTRACT 1 FROM FADG
FADG 0
=
≠
SUBTRACT 1 FROM FACT
FACT 0
≠
=
RETURN

FA00
PAGE 7

3.3.9 FILL - Fill Buffer

3.3.9.1 Purpose

FILL is a subroutine whose purpose is to store the contents of the A-register into a number of consecutive core locations.

3.3.9.2 Technical Description

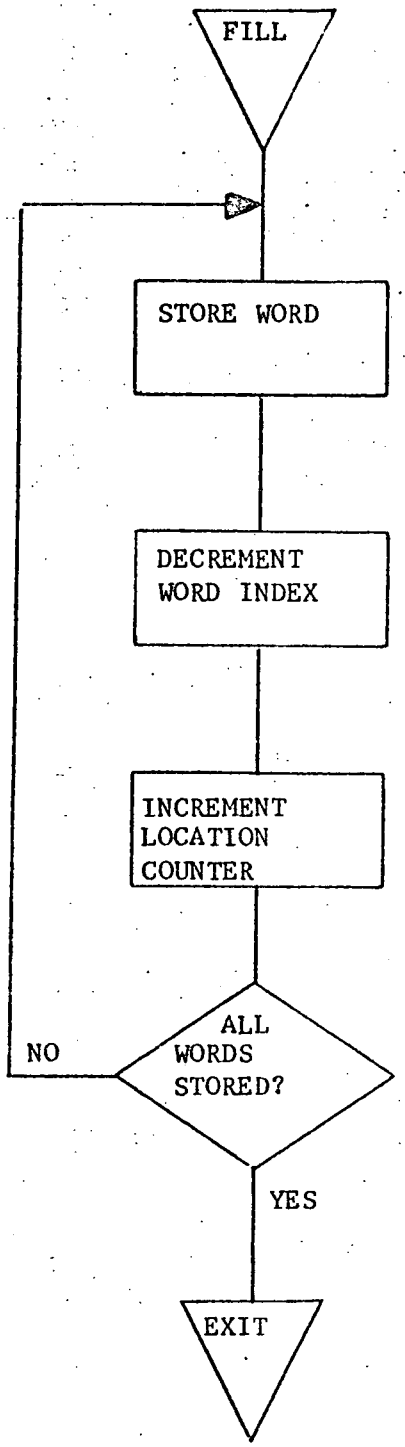
FILL stores the contents of the A-register beginning at a location whose address is specified in the B-register, into a number of consecutive locations indicated by the count contained in the X-register. A practical use of this subroutine would be in the "blank" filling of a buffer.

3.3.9.2.1 Calling Sequence

CALL FILL

REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	word to be stored	same
B	beginning location of destination buffer	address +1 of where the last word was stored
X	number of locations to fill	zero (0)
Overflow	N/A	N/A

3.3.9.2.2 General Flow Chart



3.3.9.3 Label Description

3.3.9.3.1 Local

N/A

3.3.9.3.2 Global

N/A

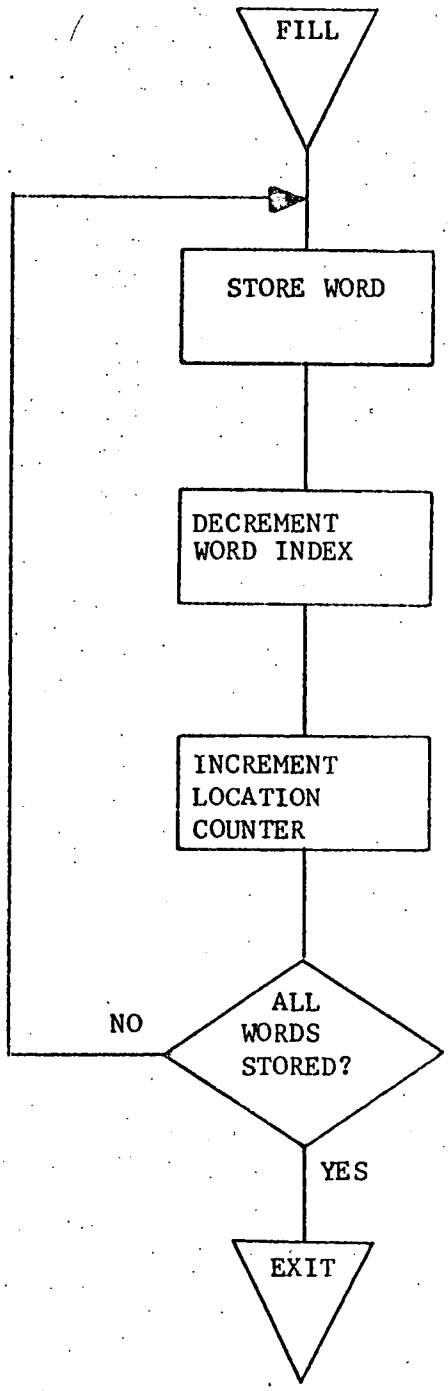
3.3.9.3.3 Entry Points

FILL - primary entry point

3.3.9.3.4 External References

N/A

3.3.9.4 Detailed Flow Chart



3.3.10 FL00 - ASCII to Floating Point

3.3.10.1 Purpose

The purpose of the subroutine FL00 is to convert a decimal number stored in a pseudo floating point format into its Varian Internal Floating Point representation.

3.3.10.2 Technical Description

The decimal number to be converted is stored in a pseudo-floating point format which uses the following four parameters to define a number: sign, total number of digits, number of digits to left of the decimal point and the address of the string of ASCII numeric characters.

The overall technical approach used in the conversion involves the repetitive multiplication and partial summing by the positional powers of 10., i.e., starting with the most significant decimal digit, a partial sum is accumulated by taking each digit, adding it to the partial sum and multiplying by 10. However, since the word size on the 620i limits us to 15 bits of accuracy, and since the number of digits input may be considerably larger, overflow may possibly result from both the multiplication and addition used in the conversion process. This overflow problem is handled in the following manner: After each multiplication or addition in the conversion process, a test for overflow is made. Should overflow occur, the overflow register indicates the multiples of 2^{15}, that is 32,768, that should be added into the partial sum. Therefore, a separate

floating point partial sum containing only the overflow multiples of 32,768 is maintained. This procedure is followed until all of the input characters have been processed. The remainder of the number which is not a multiple of 32,768, and thus not counted in the overflow partial sum, must then be converted to floating point and added to the overall floating point sum.

Should the input number to be converted contain a fractional part, that is, digits to the right of the decimal, the partial sum is adjusted by a division by the appropriate power of 10. The sign of the input number is then affixed.

3.3.10.2.1 Calling Sequence

CALL FLOO, A,B,C,D

A Address of Sign Word

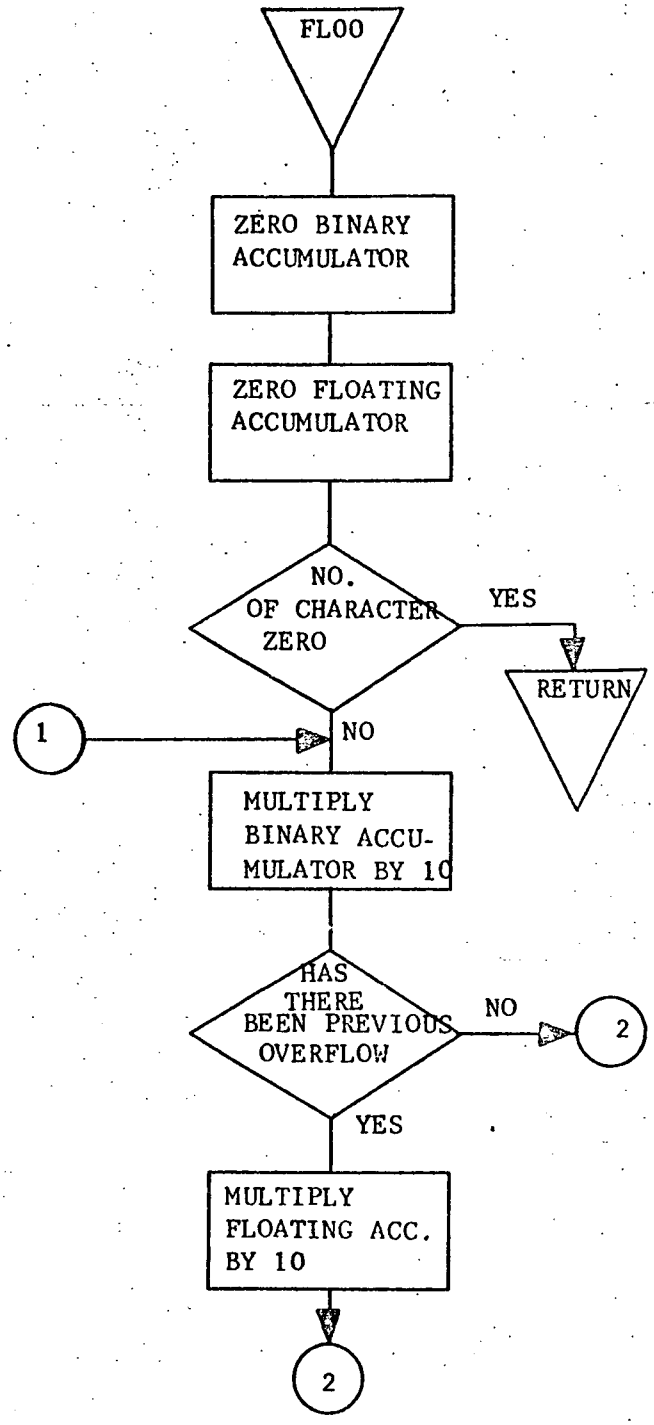
B Address of Pseudo Exponent in Binary

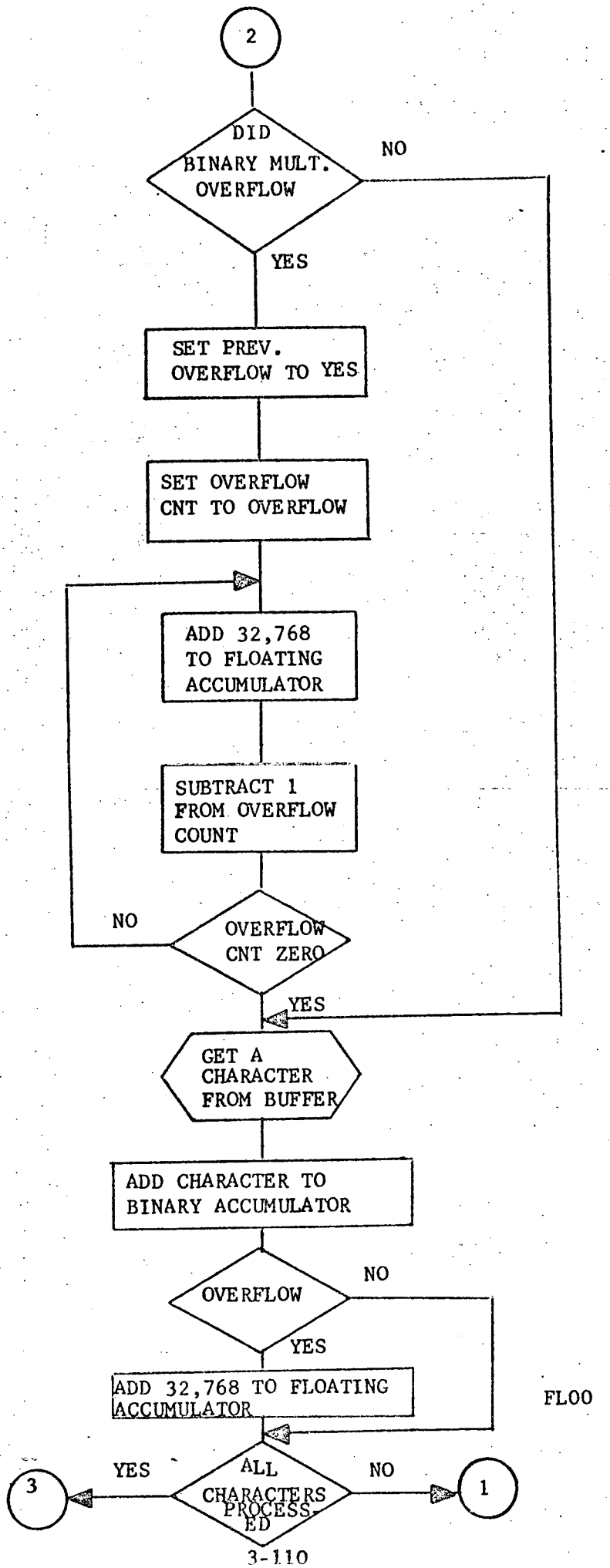
C Address of total count of number of characters to be converted

D Address of number to be converted

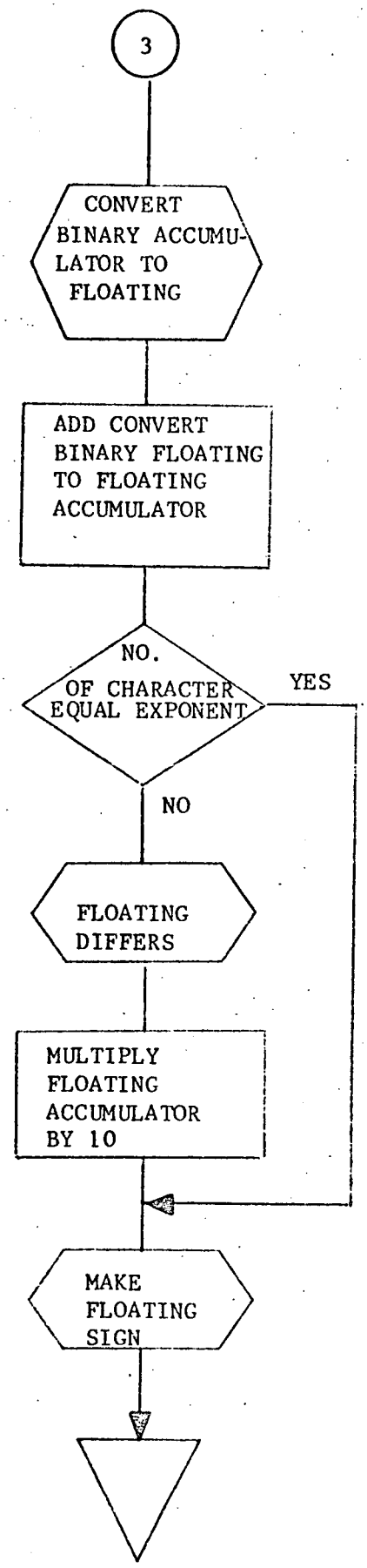
Register	Contents Upon Entry	Contents Upon Exit
A	N/A	High order of result
B	N/A	Low order of result
X	N/A	Modified
Overflow	N/A	Modified

3.3.10.2.2 General Flow Chart




2
DID BINARY MULT. OVERFLOW
NO
YES
SET PREV. OVERFLOW TO YES
SET OVERFLOW CNT TO OVERFLOW
ADD 32,768 TO FLOATING ACCUMULATOR
SUBTRACT 1 FROM OVERFLOW COUNT
NO
OVERFLOW CNT ZERO
YES
GET A CHARACTER FROM BUFFER
ADD CHARACTER TO BINARY ACCUMULATOR
OVERFLOW
NO
YES
ADD 32,768 TO FLOATING ACCUMULATOR
YES
ALL CHARACTERS PROCESSED
NO
3
1

FLOO


3
CONVERT BINARY ACCUMULATOR TO FLOATING
ADD CONVERT BINARY FLOATING TO FLOATING ACCUMULATOR
NO. OF CHARACTER EQUAL EXPONENT
YES
NO
FLOATING DIFFERS
MULTIPLY FLOATING ACCUMULATOR BY 10
MAKE FLOATING SIGN

3.3.10.3 Label Description

3.3.10.3.1 Local

FLCH	Binary character to be converted
FLMA	Floating point 32,768.0
FLM3	Working storage for floating point number
FLSW	Overflow switch
FLS1	Binary accumulator
FLS2	Floating Accumulator
FLTC	Address of count
FLTE	Address of pseudo exponent
FLTM	Address of first character of number to be converted
FLTN	Floating point 10.0
FLTS	Address of sign word
FLXI	Total count on the number
FLZO	Floating zero

3.3.4.3.2 Global

None

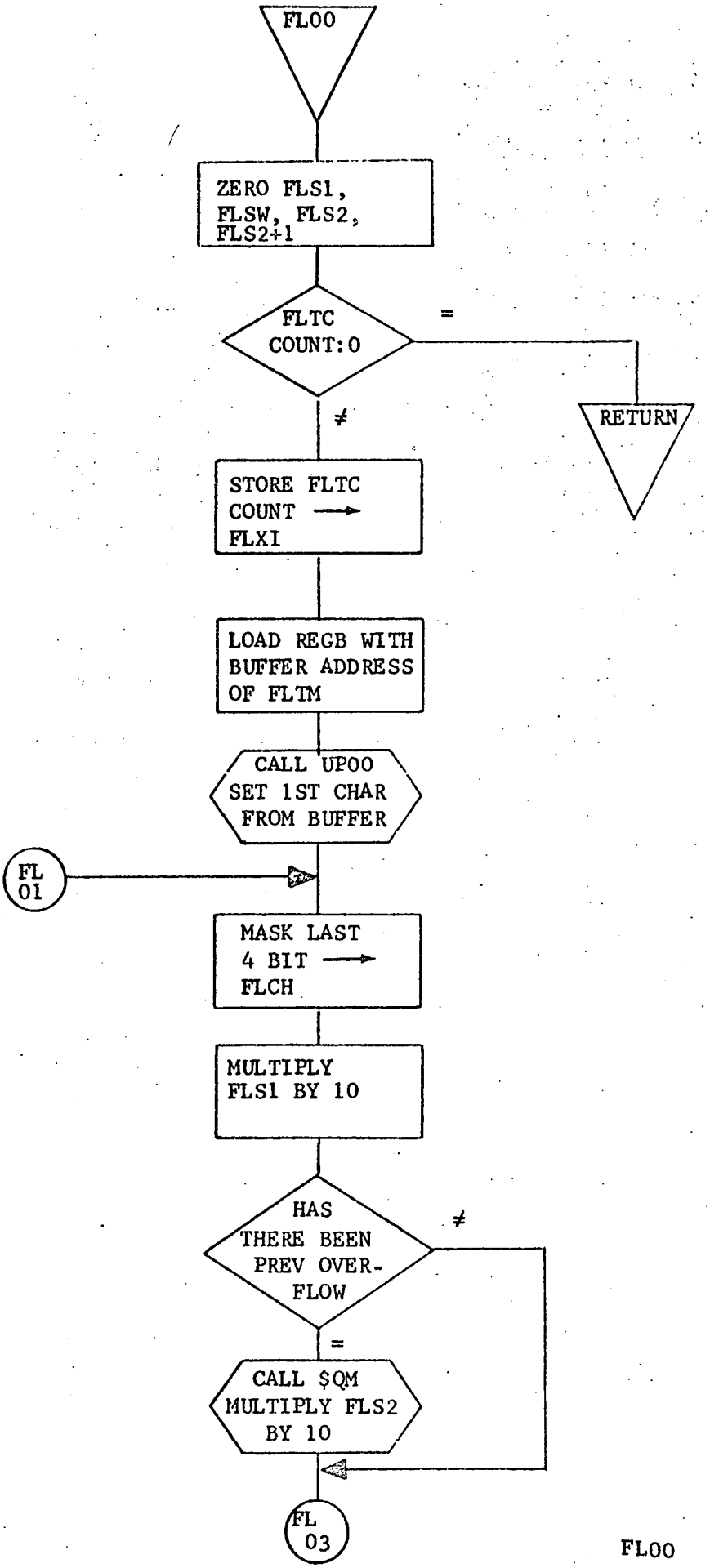
3.3.4.3.3 Entry Points

FL00

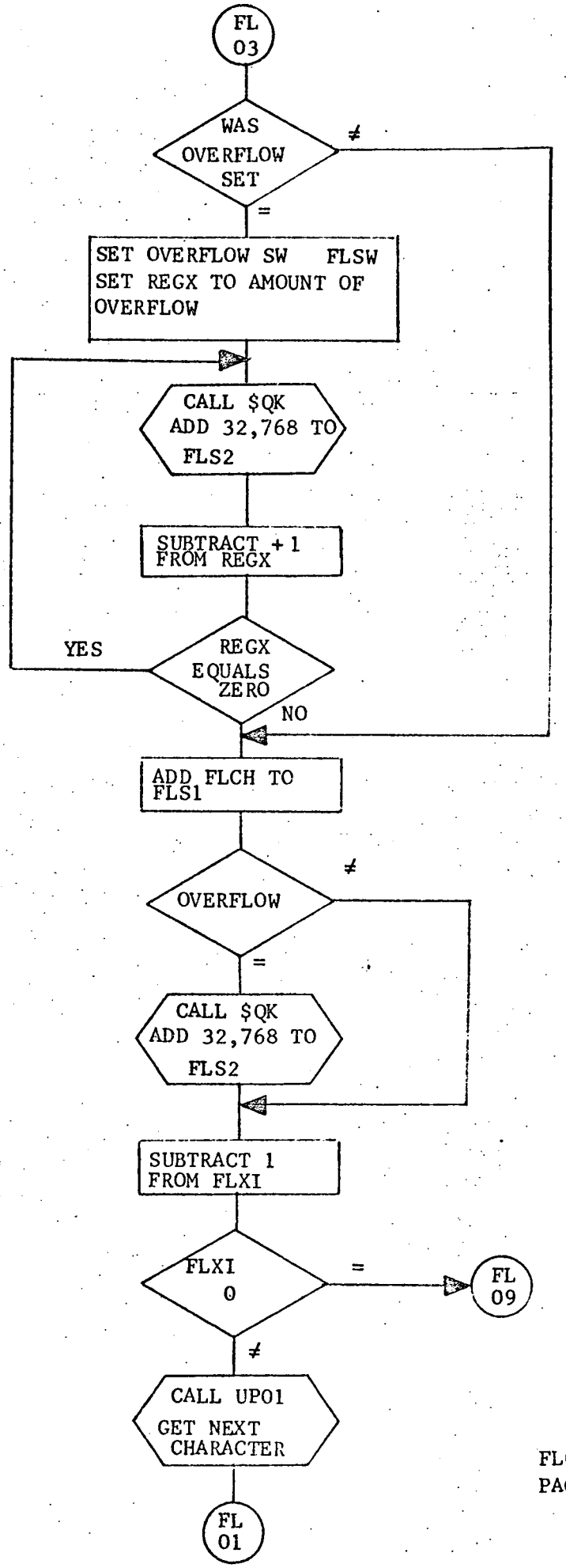
3.3.10.3.4 External References

SIGN	Subroutine to copy Sign.
UP00	Subroutine to unpack first character.
UP01	Subroutine to unpack character.
$QE	Subroutine to perform floating exponentiation.
$QK	Subroutine to perform floating point add.
$QM	Subroutine to perform floating point multiply.
$QS	Subroutine to convert integer number to floating number.
$SE	Subroutine to save parameters.

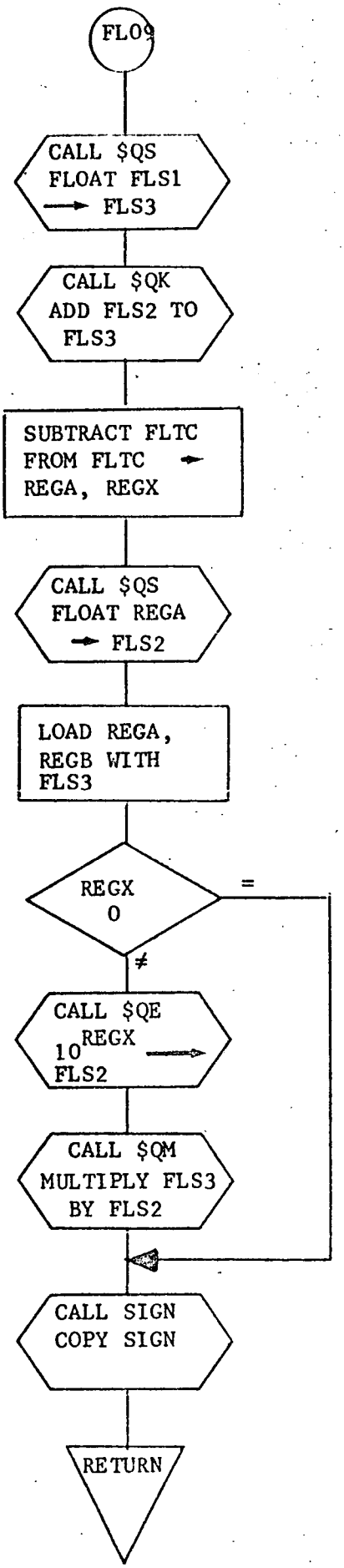
3.3.10.4 Detailed Flow Chart



FL00
PAGE 1


FL 03
WAS OVERFLOW SET
≠
=
SET OVERFLOW SW FLSW
SET REGX TO AMOUNT OF OVERFLOW
CALL $QK
ADD 32,768 TO FLS2
SUBTRACT +1 FROM REGX
YES
REGX EQUALS ZERO
NO
ADD FLCH TO FLS1
OVERFLOW
≠
=
CALL $QK
ADD 32,768 TO FLS2
SUBTRACT 1 FROM FLXI
FLXI 0
=
FL 09
≠
CALL UP01
GET NEXT CHARACTER
FL 01

FL00
PAGE 2


FLO9
CALL $QS
FLOAT FLS1
→ FLS3
CALL $QK
ADD FLS2 TO
FLS3
SUBTRACT FLTC
FROM FLTC →
REGA, REGX
CALL $QS
FLOAT REGA
→ FLS2
LOAD REGA,
REGB WITH
FLS3
REGX
0
=
≠
CALL $QE
10^REGX →
FLS2
CALL $QM
MULTIPLY FLS3
BY FLS2
CALL SIGN
COPY SIGN
RETURN

FLOO
PAGE 3

3.3.11 HM00 - Magnetic Tape Handler

3.3.11.1 Purpose

HM00 is a general purpose tape routine capable of handling all available tape functions. The purpose of this routine is to reduce the duplication of effort that is inherit when individual users develop their own coding to handle each specific tape I/O operation. The routine currently does not return control to the calling program until I/O is complete or an error is detected, but as soon as additional interrupts are available on the DOC system, the routine will be modified to allow overlapped processing during tape operations.

3.3.11.2 Technical Description

HM00 allows input or output of variable length tape records. The Model 620i-31 Magnetic Tape System Controller is capable of performing 8 functions (see Calling Sequence 3.3.8.2.1) all of which are handled by HM00. The BIC is used for input and output operations. HM00 first sets up the BIC instructions by using the MTU number received in the call and saves the MTU number for later use in building the actual tape instruction. The starting buffer address is picked up from the call; the ending address is computed by using the number of words to be transferred in the call, and the BIC initial and BIC final addresses are output to the BIC. The tape function is picked up from the arguments and combined with the MTU number to create the tape instruction. The I/O operation is then executed. After completion of the I/O, HM00 checks the status of the MTU and returns that status to the calling program as the fifth parameter of the call.

3.3.11.2.1 Calling Sequence

CALL HM00,A,B,C,D,STAT

PARAMETER	FUNCTION
A	Address of location containing tape function to be performed. 0 = input binary 1 = input BCD 2 = output binary 3 = output BCD 4 = Write End of File 5 = Forward one record 6 = Backspace one record 7 = Rewind
B	Beginning location of buffer (not to exceed (37777_8)
C	Address of location containing number of words to transfer
D	Address of location containing unit number (10_8 or 11_8)
STAT	Address of location containing Status of I/O operation. (Output by HM00 to calling program.)

STAT = ≥ 0 I/O completed successfully. Number indicates number of words transferred.

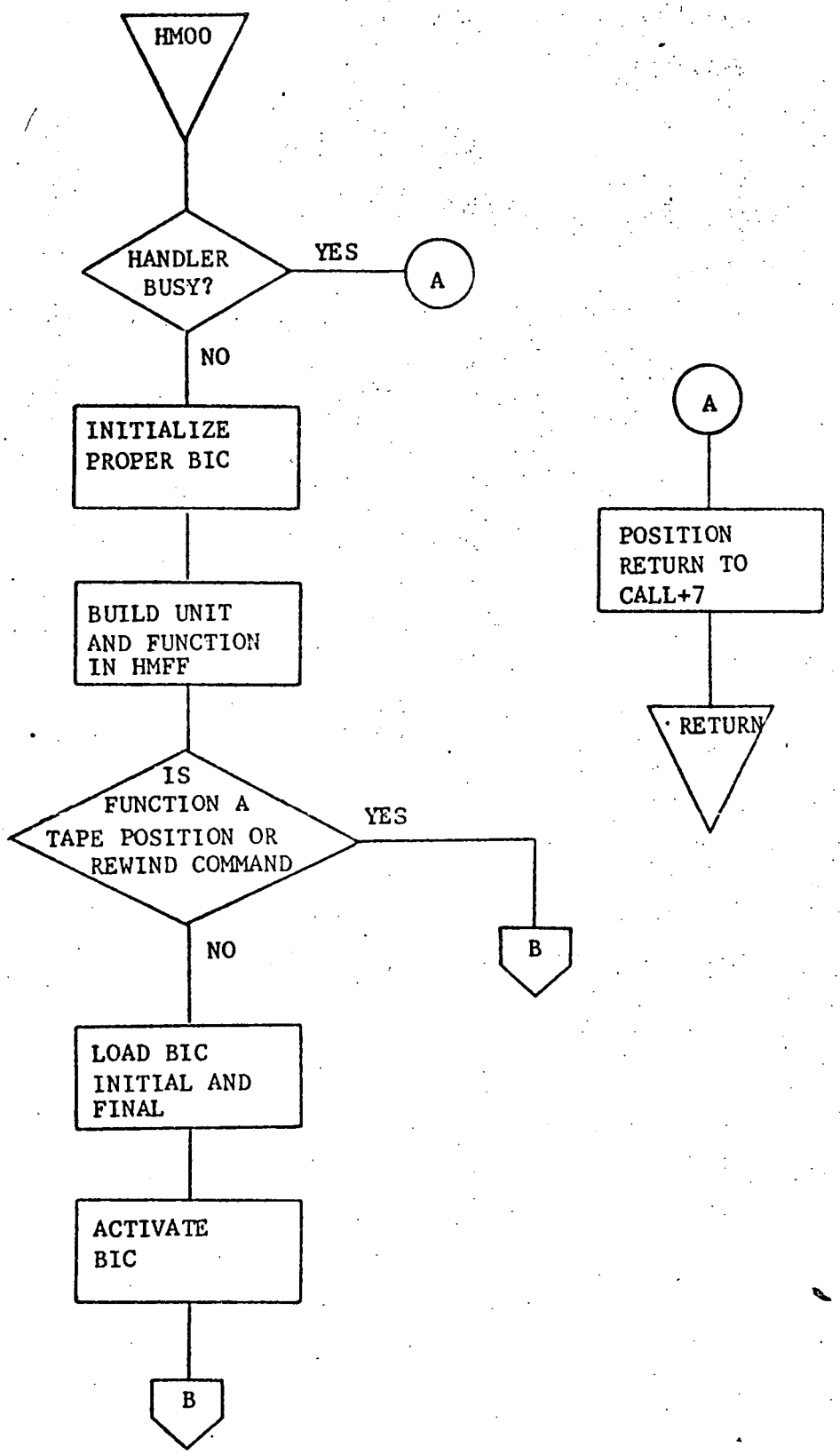
STAT = -1 User requested I/O still in progress. (to be implemented)

3.3.11.2.1 Calling Sequence (Continued

PARAMETER	FUNCTION
	STAT = -2 End of File
	STAT = -3 Tape Error
	STAT = -4 End of Tape
	STAT = -5 Beginning of Tape
Busy Return	CALL+7
	Handler busy processing a previous I/O request.
Normal Return	Call +9
	Requested I/O complete. User must check STAT for errors or number of words transferred.

REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	Saved	Same as Entry
B	Saved	Same as Entry
X	Saved	Same as Entry
Overflow	Not effected	Same as Entry

3.3.11.2.2 General Flow Chart



3.3.11.3 Label Description

3.3.11.3.1 Local

HM1 - HM5, HM15	Locations of BIC instructions initialied by HM00
HM01	Location where tape I/O instruction is constructed and executed.
HMA	Save area for A-register.
HMAB	Indirect address for unit number.
HMA3	Initialize BIC 2 instruction. Used for initialization.
HMA4	Initialize BIC 4 instruction.
HMB	Save area for B-register.
HMBA	Beginning address of buffer. Used to compute number of words transferred.
HMBU	Previous I/O in progress (to be implemented).
HMB3	Sense BIC 2 not busy instruction. Used for initialization.
HMB4	Sense BIC 4 not busy instruction. Used for initialization.
HMC3	Set BIC 2 starting address instruction. Used for initialization.
HMC4	Set BIC 4 starting address instruction. Used for initialization.
HMD3	Set BIC 2 final address instruction. Used for initialization.
HMD4	Set BIC 4 starting address instruction. Used for initialization.
HME3	Enable BIC 2 instruction. Used for initialization.
HME4	Enable BIC 4 instruction. Used for initialization.
HMFF	Tape function being performed.

3.3.11.3.1 Local (Continued)

HMF3	Location containing a "load BIC 2 initial register" instruction. Used for initialization.
HMF4	Location containing a "load BIC 4 initial register" instruction. Used for initialization.
HMUN	Unit number.
HMX	Save area for X-register.
HMXX	Indirect argument pointer.

3.3.11.3.2 Global

HM00	Entry point into subroutine.

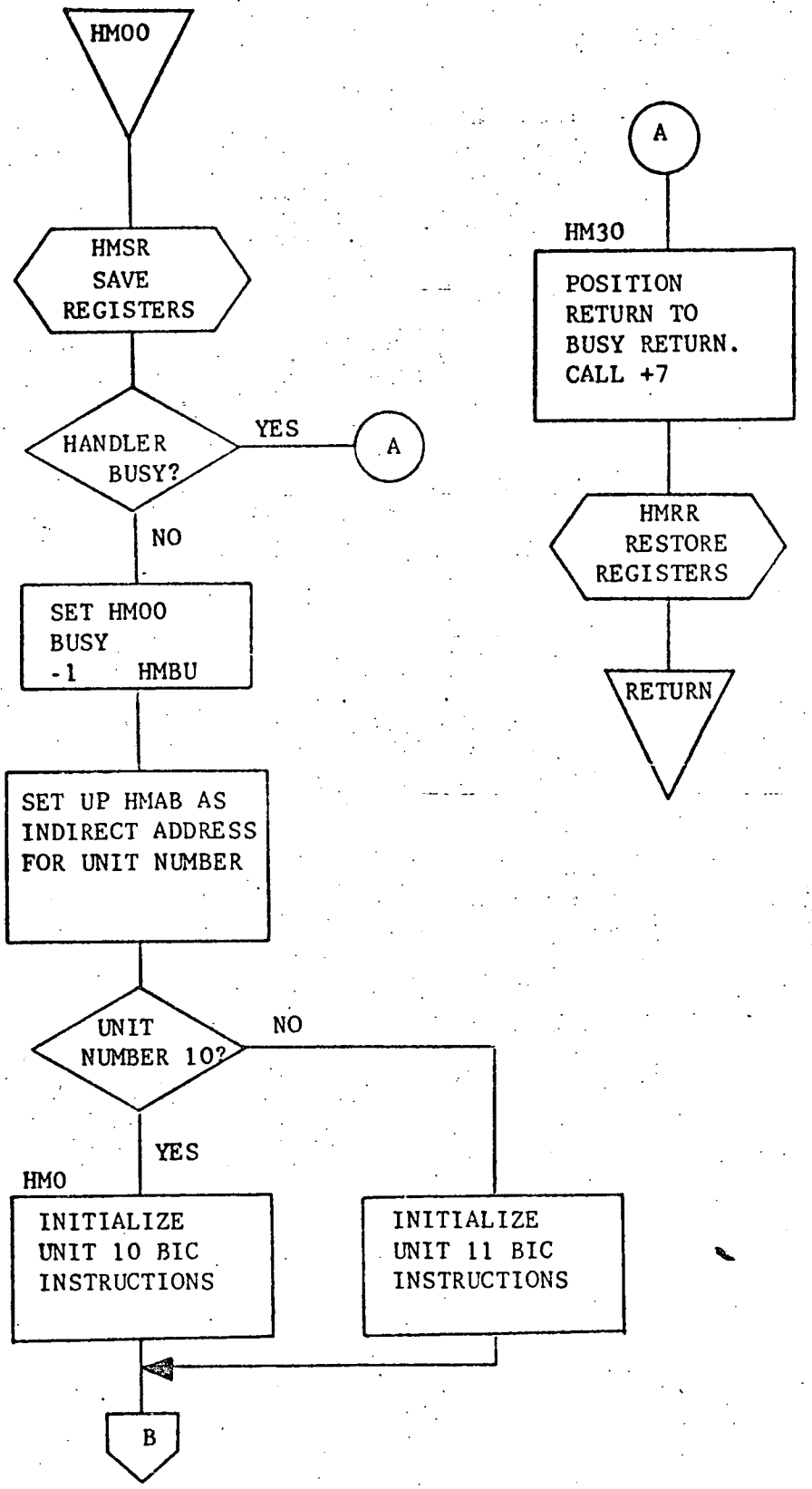
3.3.11.3.3 Entry Points

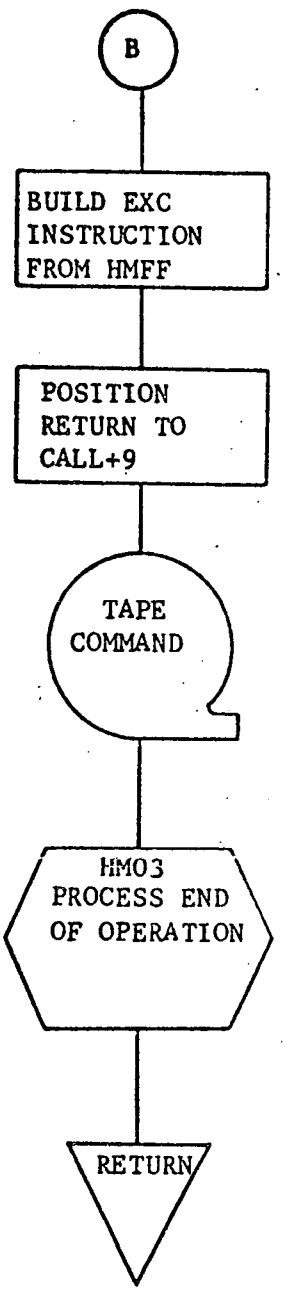
HM00 primary entry point

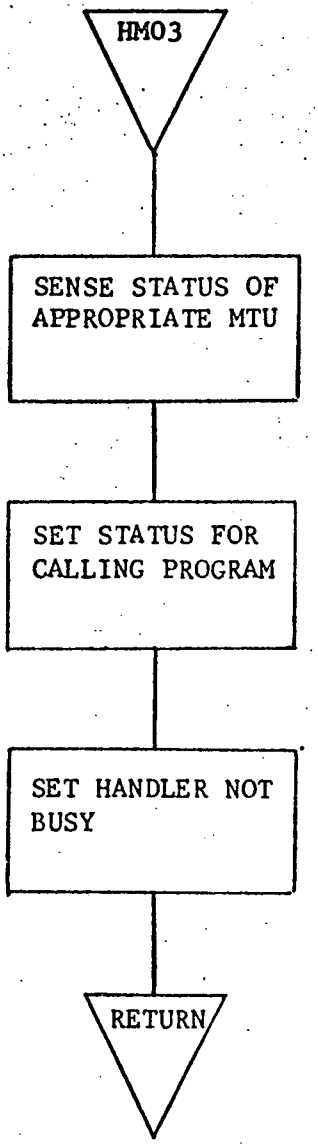
3.3.11.3.4 External References

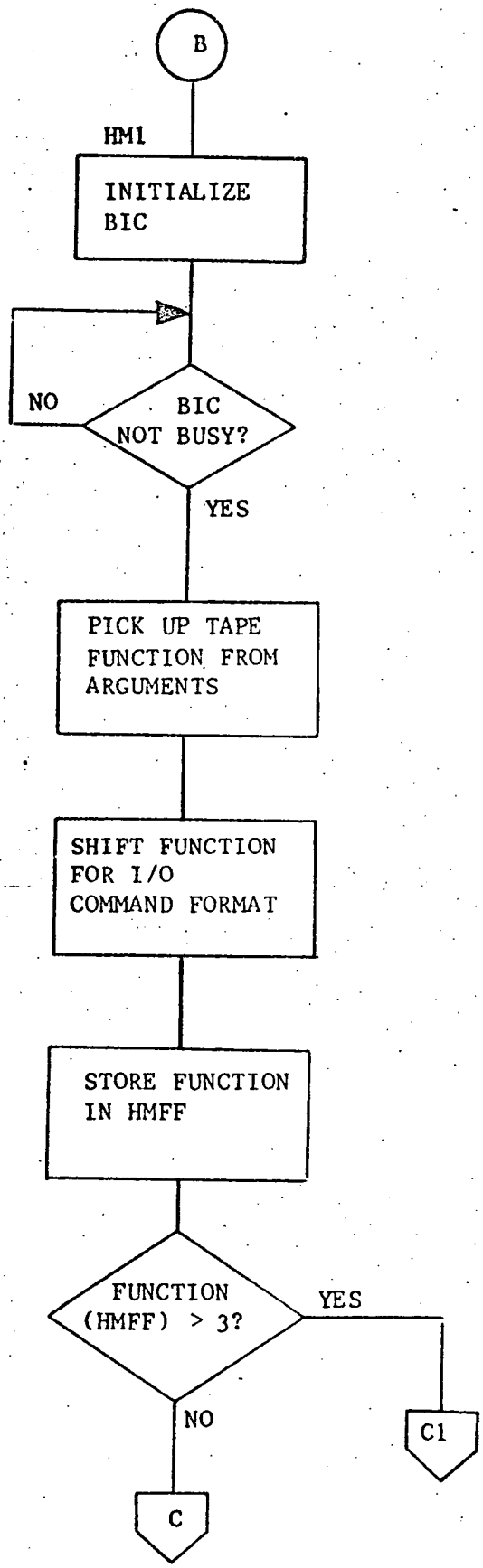
None.

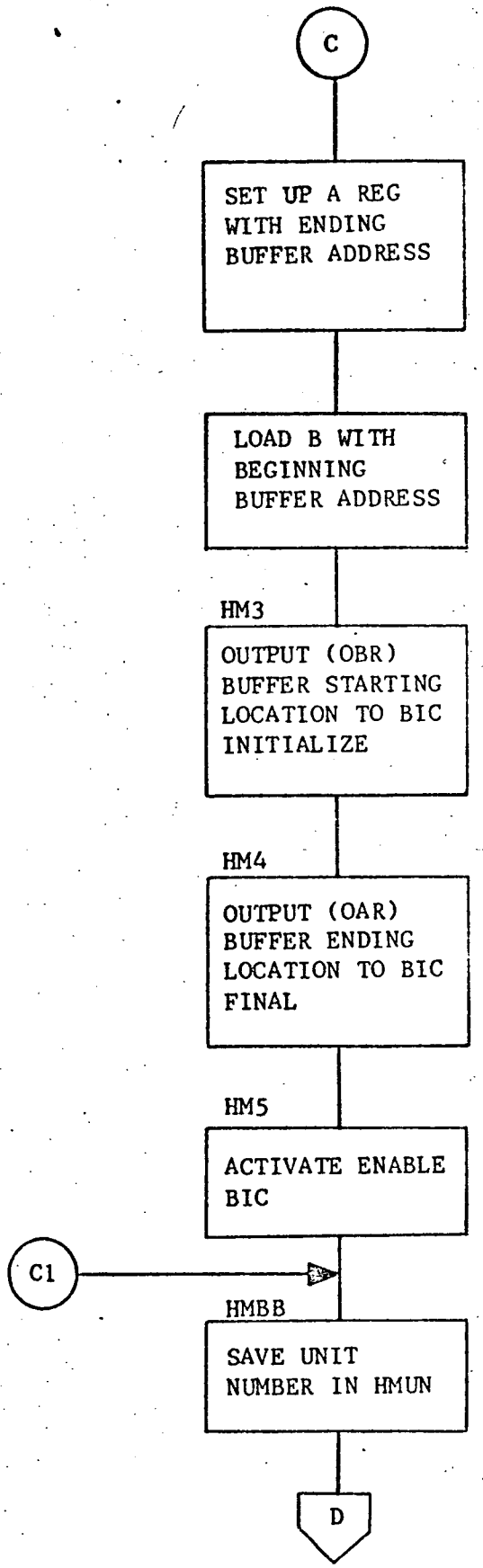
3.3.11.4 Detailed Flow Chart

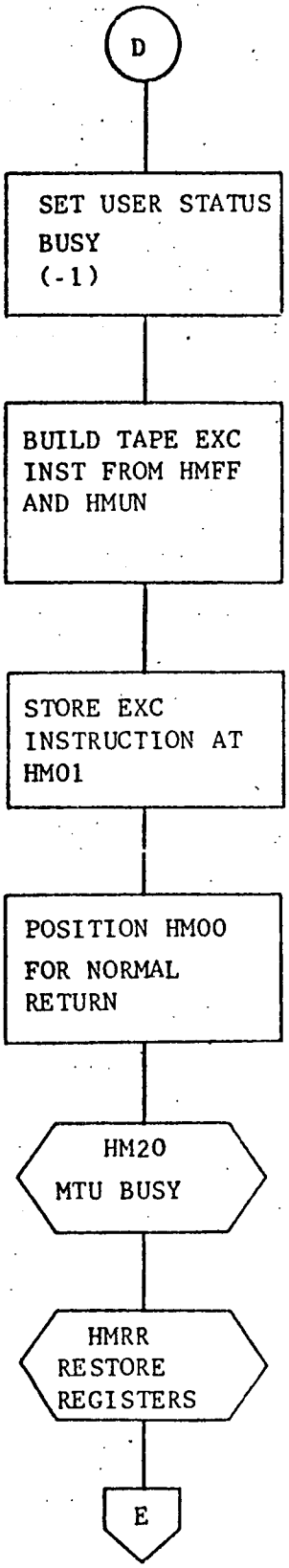


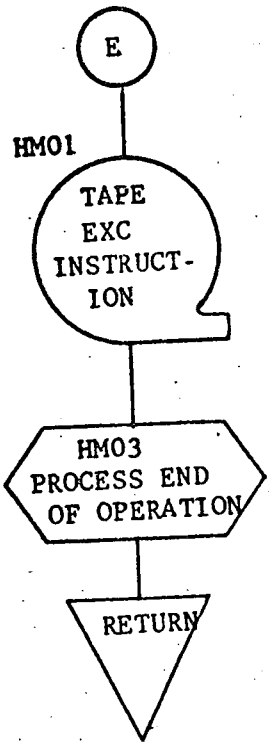

B
BUILD EXC INSTRUCTION FROM HMFF
POSITION RETURN TO CALL+9
TAPE COMMAND
HM03 PROCESS END OF OPERATION
RETURN

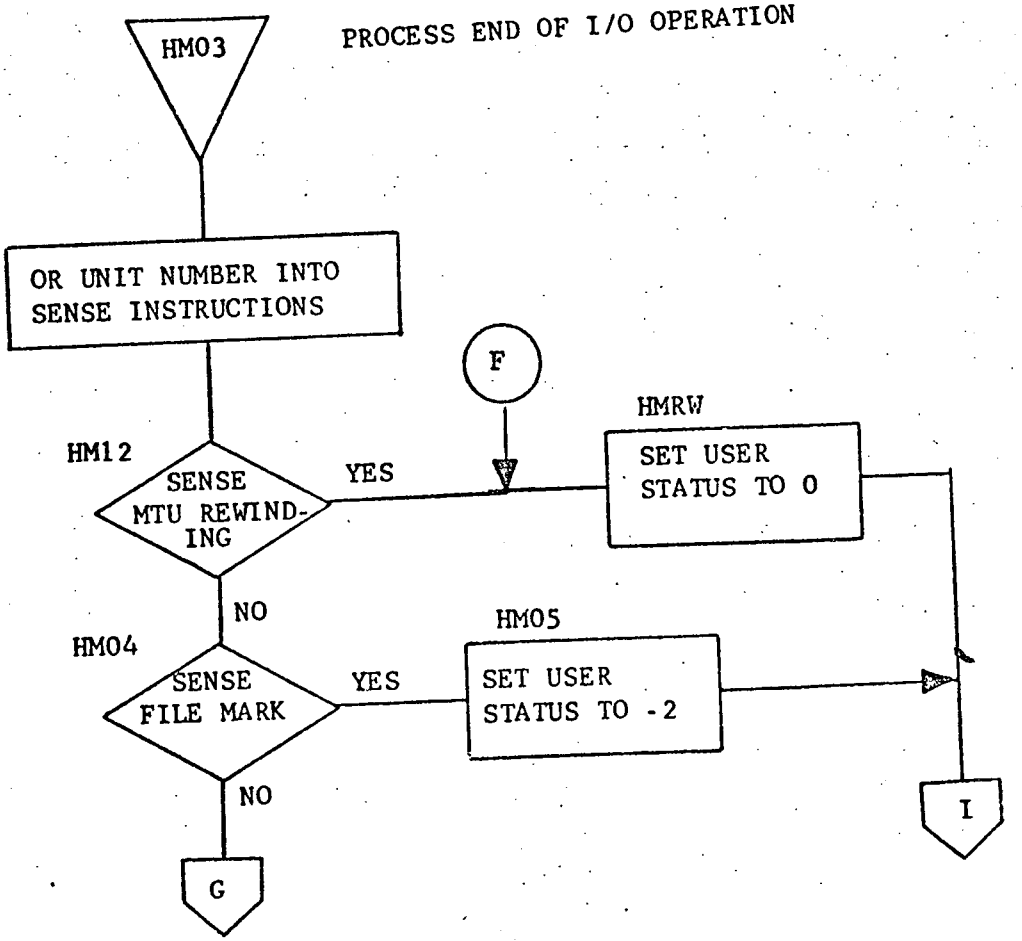

HM03
SENSE STATUS OF APPROPRIATE MTU
SET STATUS FOR CALLING PROGRAM
SET HANDLER NOT BUSY
RETURN

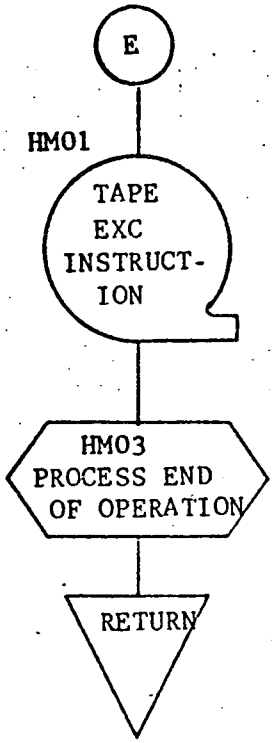

B
HM1
INITIALIZE BIC
NO
BIC NOT BUSY?
YES
PICK UP TAPE FUNCTION FROM ARGUMENTS
SHIFT FUNCTION FOR I/O COMMAND FORMAT
STORE FUNCTION IN HMFF
FUNCTION (HMFF) > 3?
YES
NO
C1
C

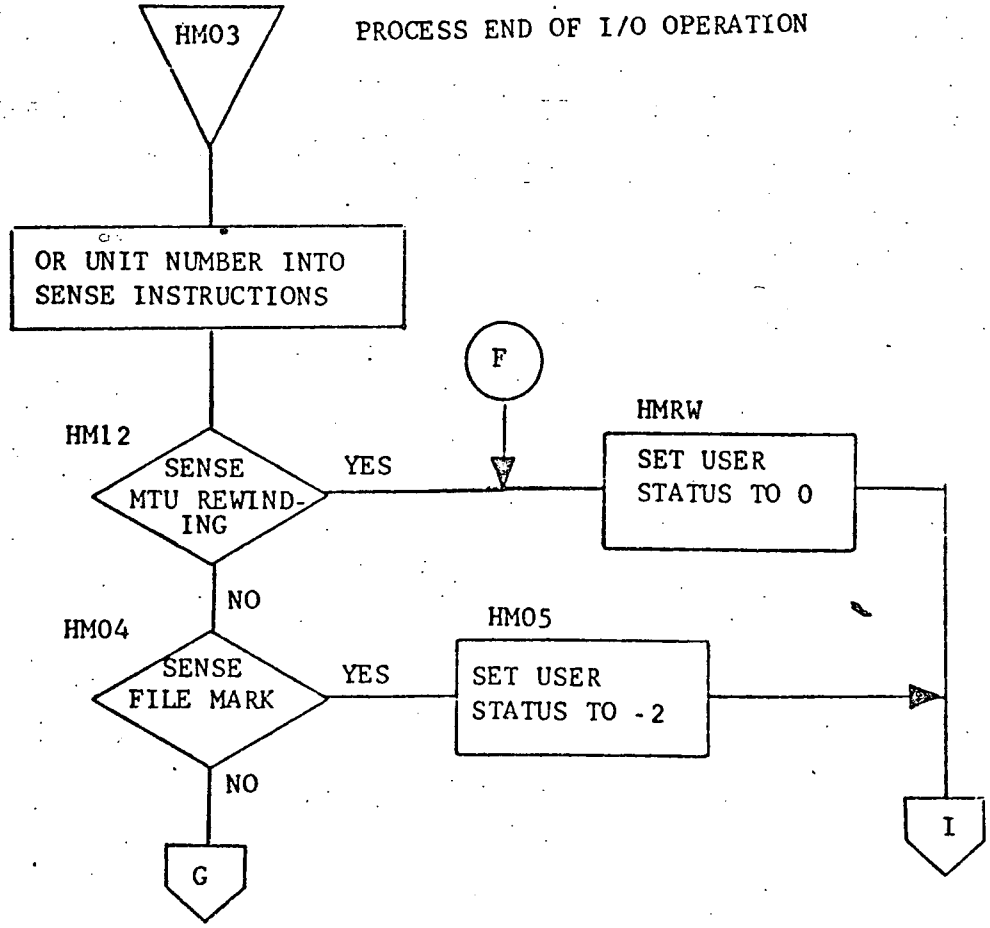

C
SET UP A REG WITH ENDING BUFFER ADDRESS
LOAD B WITH BEGINNING BUFFER ADDRESS
HM3
OUTPUT (OBR) BUFFER STARTING LOCATION TO BIC INITIALIZE
HM4
OUTPUT (OAR) BUFFER ENDING LOCATION TO BIC FINAL
HM5
ACTIVATE ENABLE BIC
C1
HMBB
SAVE UNIT NUMBER IN HMUN
D

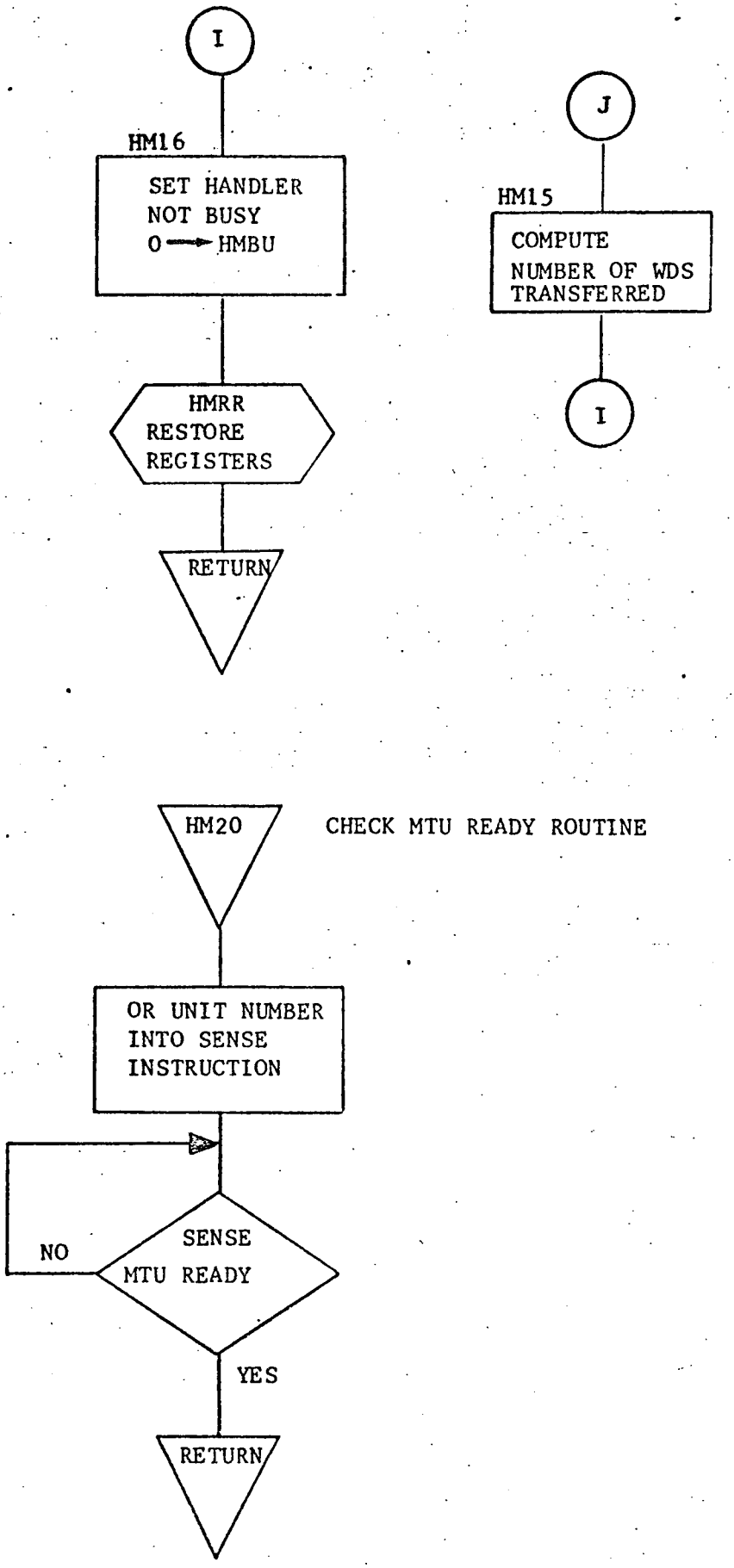

D
SET USER STATUS BUSY (-1)
BUILD TAPE EXC INST FROM HMFF AND HMUN
STORE EXC INSTRUCTION AT HM01
POSITION HM00 FOR NORMAL RETURN
HM20 MTU BUSY
HMRR RESTORE REGISTERS
E

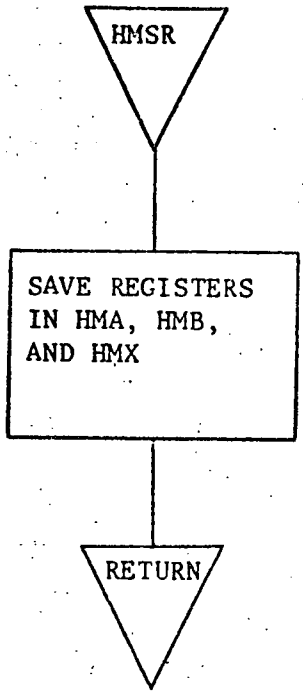

E
HM01
TAPE EXC INSTRUCT-ION
HM03 PROCESS END OF OPERATION
RETURN

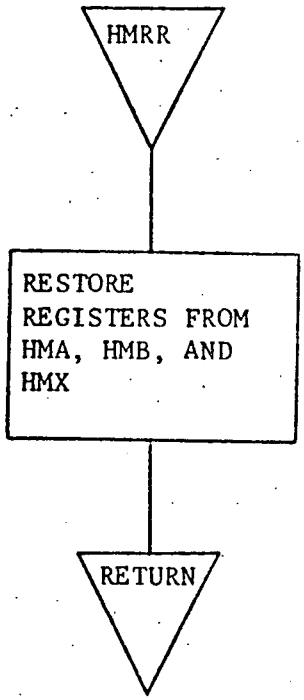

HM03
PROCESS END OF I/O OPERATION
OR UNIT NUMBER INTO SENSE INSTRUCTIONS
F
HMRW
HM12
SENSE MTU REWIND-ING
YES
SET USER STATUS TO 0
NO
HM05
HM04
SENSE FILE MARK
YES
SET USER STATUS TO -2
NO
I
G


E
HM01
TAPE EXC INSTRUCT-ION
HM03 PROCESS END OF OPERATION
RETURN


HM03
PROCESS END OF I/O OPERATION
OR UNIT NUMBER INTO SENSE INSTRUCTIONS
F
HMRW
HM12
SENSE MTU REWIND-ING
YES
SET USER STATUS TO 0
NO
HM04
HM05
SENSE FILE MARK
YES
SET USER STATUS TO -2
NO
I
G


I
HM16
SET HANDLER
NOT BUSY
0 → HMBU
HMRR
RESTORE
REGISTERS
RETURN
J
HM15
COMPUTE
NUMBER OF WDS
TRANSFERRED
I
HM20
CHECK MTU READY ROUTINE
OR UNIT NUMBER
INTO SENSE
INSTRUCTION
SENSE
MTU READY
NO
YES
RETURN


HMSR
SAVE REGISTERS IN HMA, HMB, AND HMX
RETURN


HMRR
RESTORE REGISTERS FROM HMA, HMB, AND HMX
RETURN

3.3.12 IAAR Input TTY or Modem

3.3.12.1 Purpose

The purpose of IAAR is to input a string of characters into a user specified buffer from the CLINC TTY's, DOC TTY, or DOC 103 Modem.

3.3.12.2 Technical Description

IAAR gains control when it is called by the generalized Input Message (IM00) Routine. The complete input string is stored in the user buffer before the user status word is updated and control is returned to IM00. As soon as character interrupts are available on the DOC system, IM00 may be modified to return control to the original calling program when input of the first character is initiated. IAAR calls the Input Character Routine (ISB1) to input, edit, and echo each input character. The input instructions in ISB1 are set up for the assigned input device by the Initialize System (IS00) Routine.

In addition to inputting and packing the input message, IAAR checks for several input control characters and terminates the input accordingly. If an input complete code (*) is received, the user status word is set to the number of characters packed in the input buffer and control is returned to the user via IM00.

If a cancel line ($) character is detected, a (-3) status is returned. If a cancel retrieval request (@) character is received, a (-4) status is returned. Finally, if the maximum number of input characters allowed by the user program is reached, the operation status word is set to that number and control returned to the calling program. (Note that the *, $, @, CR, and LF are not stored or counted by IAAR).

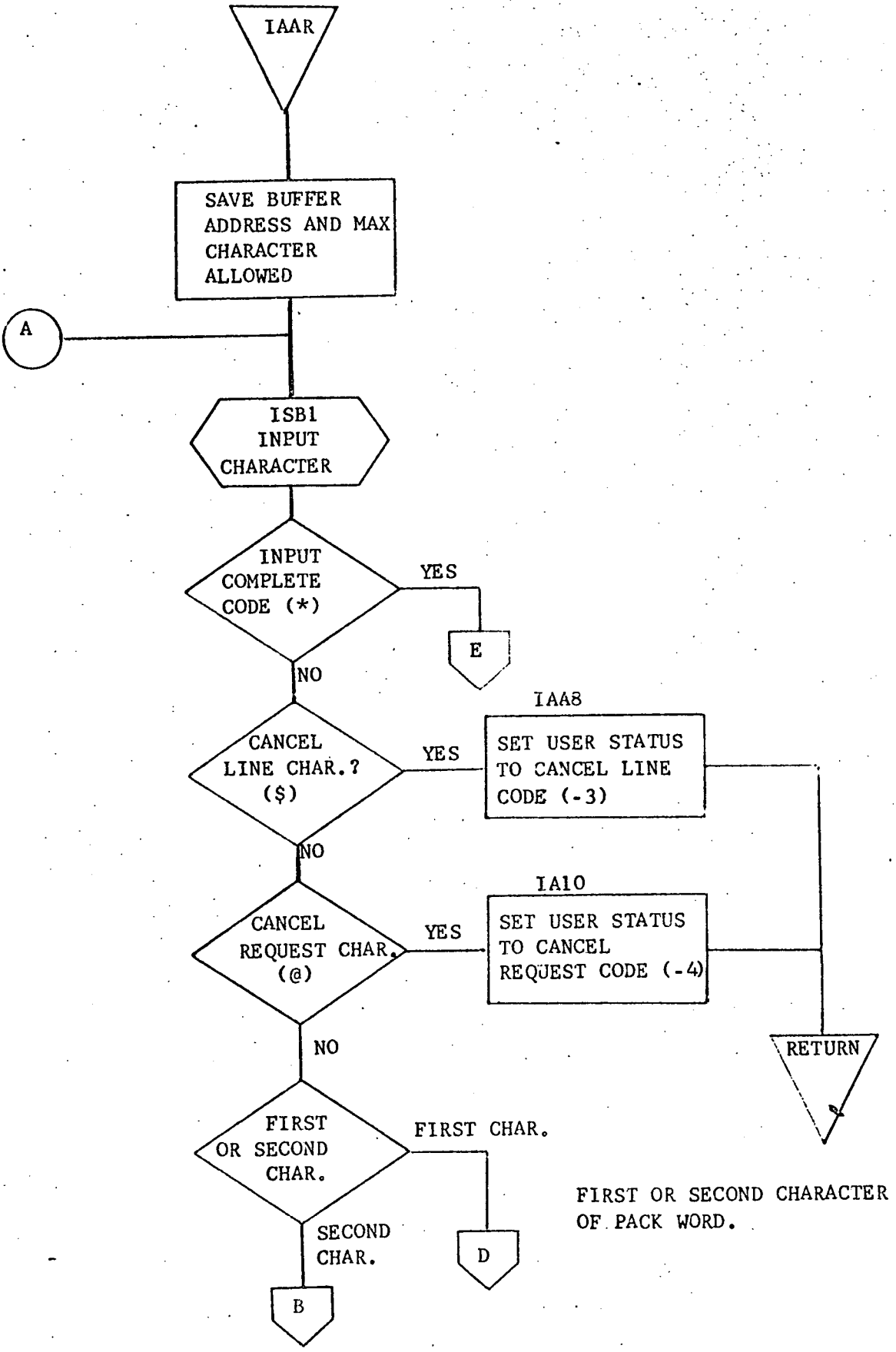
3.3.12.2.1 Calling Sequence

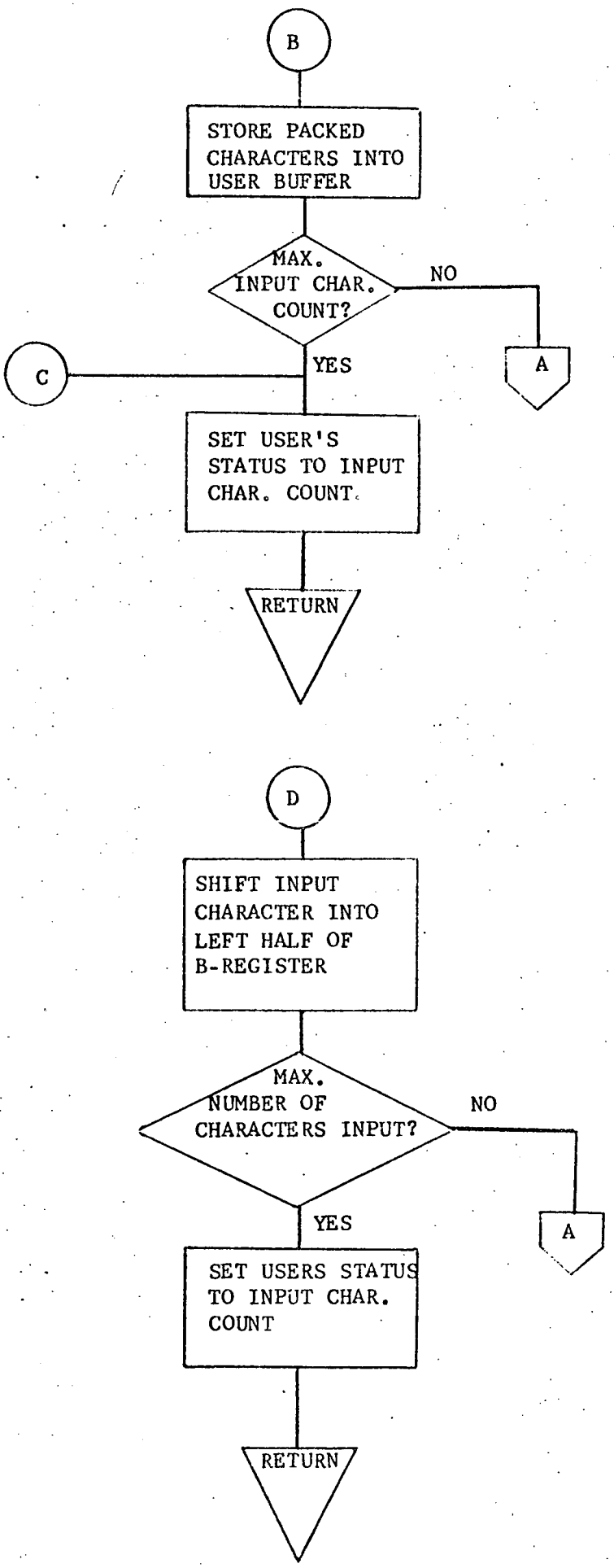
CALL IAAR, A,B

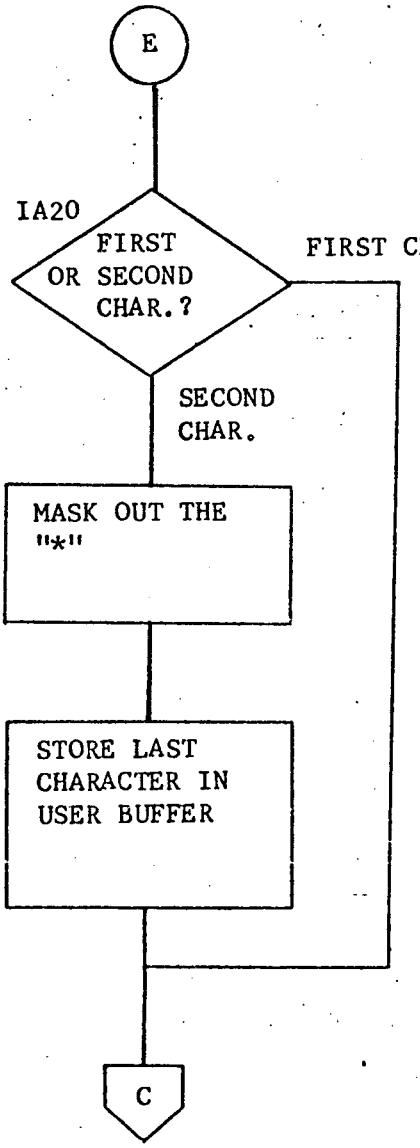
PARAMETER	FUNCTION
A	Address of input buffer.
B	Maximum number of characters allowed for the input buffer.

REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	N/A	Modified
B	N/A	Modified
X	N/A	Modified
Overflow	N/A	Modified

3.3.12.2.2 General Flow Chart




B
STORE PACKED CHARACTERS INTO USER BUFFER
MAX. INPUT CHAR. COUNT?
NO
YES
C
A
SET USER'S STATUS TO INPUT CHAR. COUNT.
RETURN
D
SHIFT INPUT CHARACTER INTO LEFT HALF OF B-REGISTER
MAX. NUMBER OF CHARACTERS INPUT?
NO
YES
A
SET USERS STATUS TO INPUT CHAR. COUNT
RETURN



FIRST OR SECOND CHARACTER OF PACK WORD BEING PROCESSED.

3.3.12.3 Label Description

3.3.12.3.1 Local

IAAC - Location containing actual input character count.

IAA9 - Location containing incremented buffer address.

IA12 - Save area for maximum input characters allowed.

3.3.12.3.2 Global

None

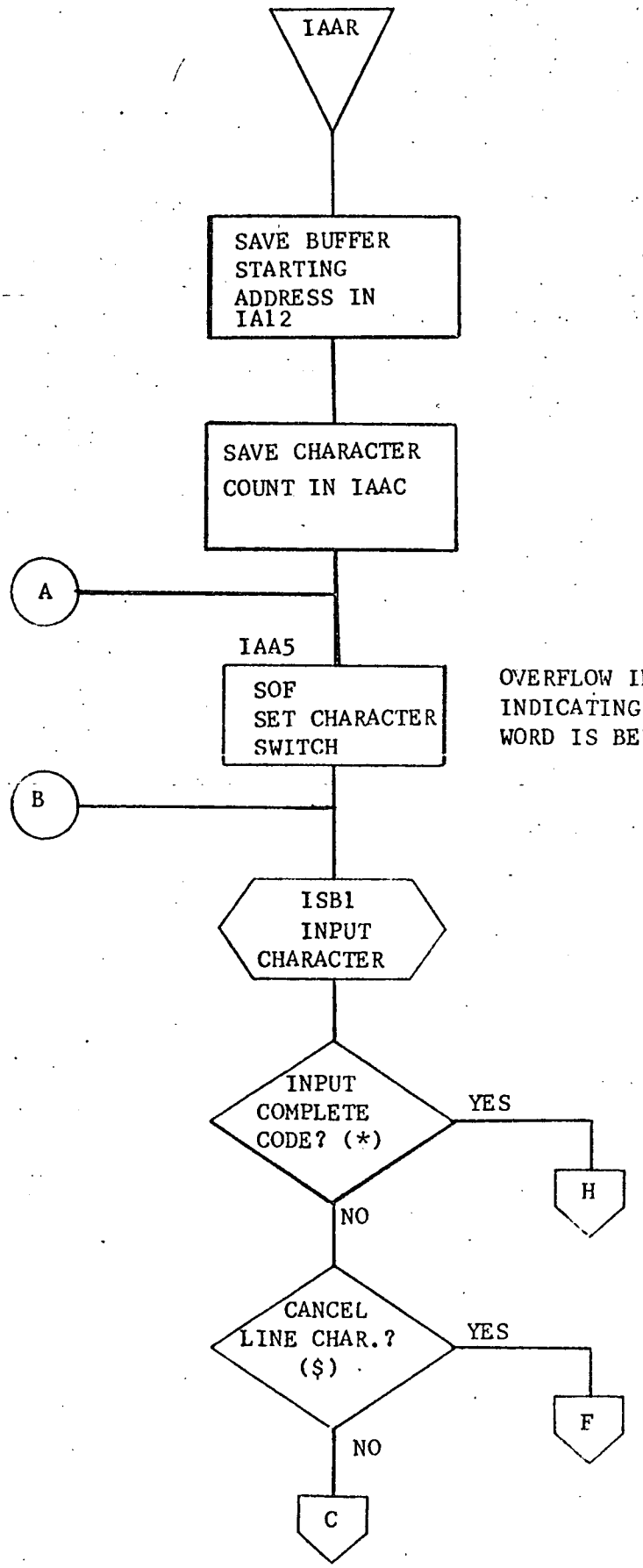
3.3.12.3.3 Entry Points

IAAR

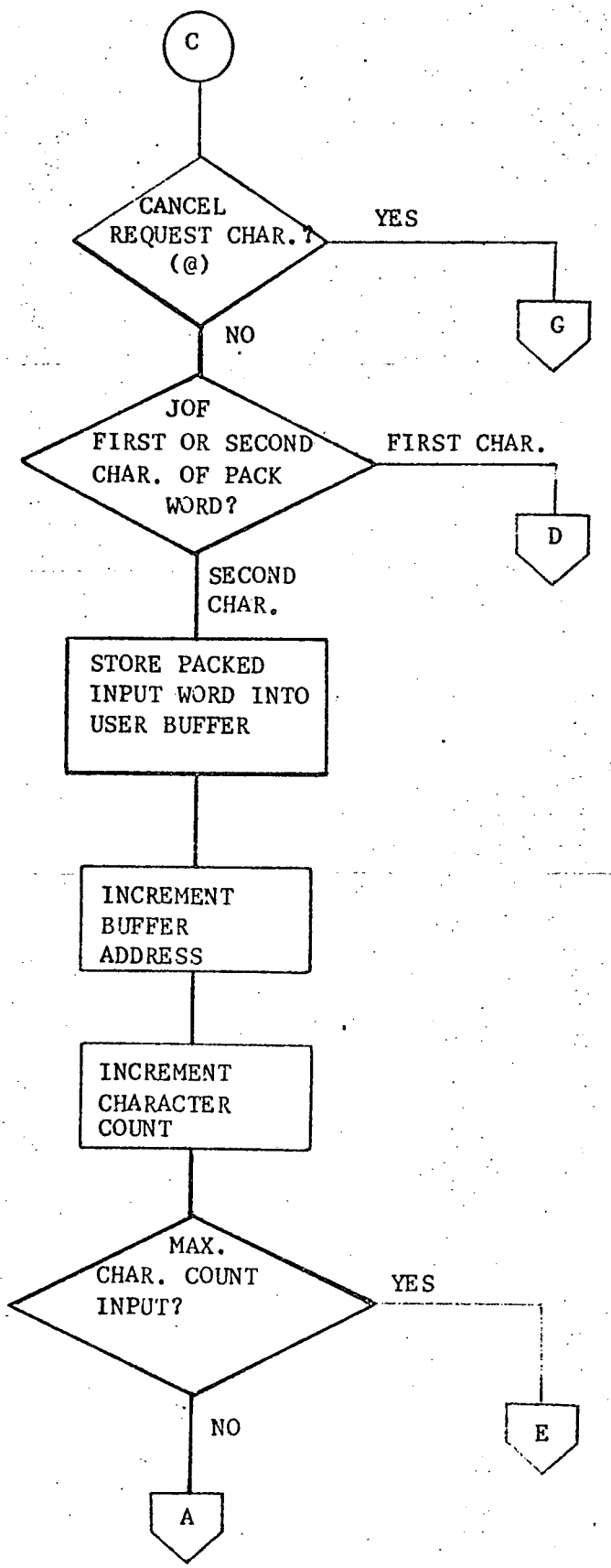
3.3.12.3.4 External References

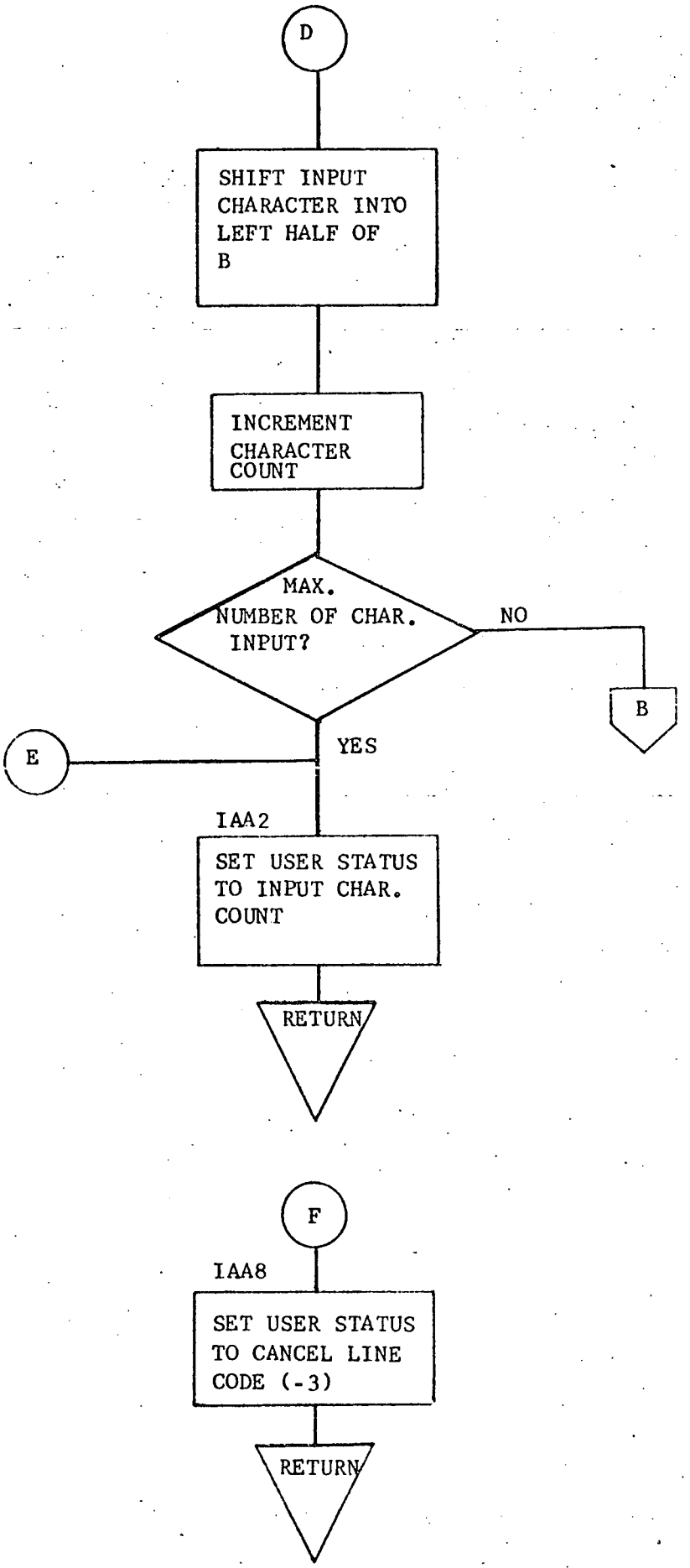
ISB1 - Subroutine called to input, edit, and echo each input character.

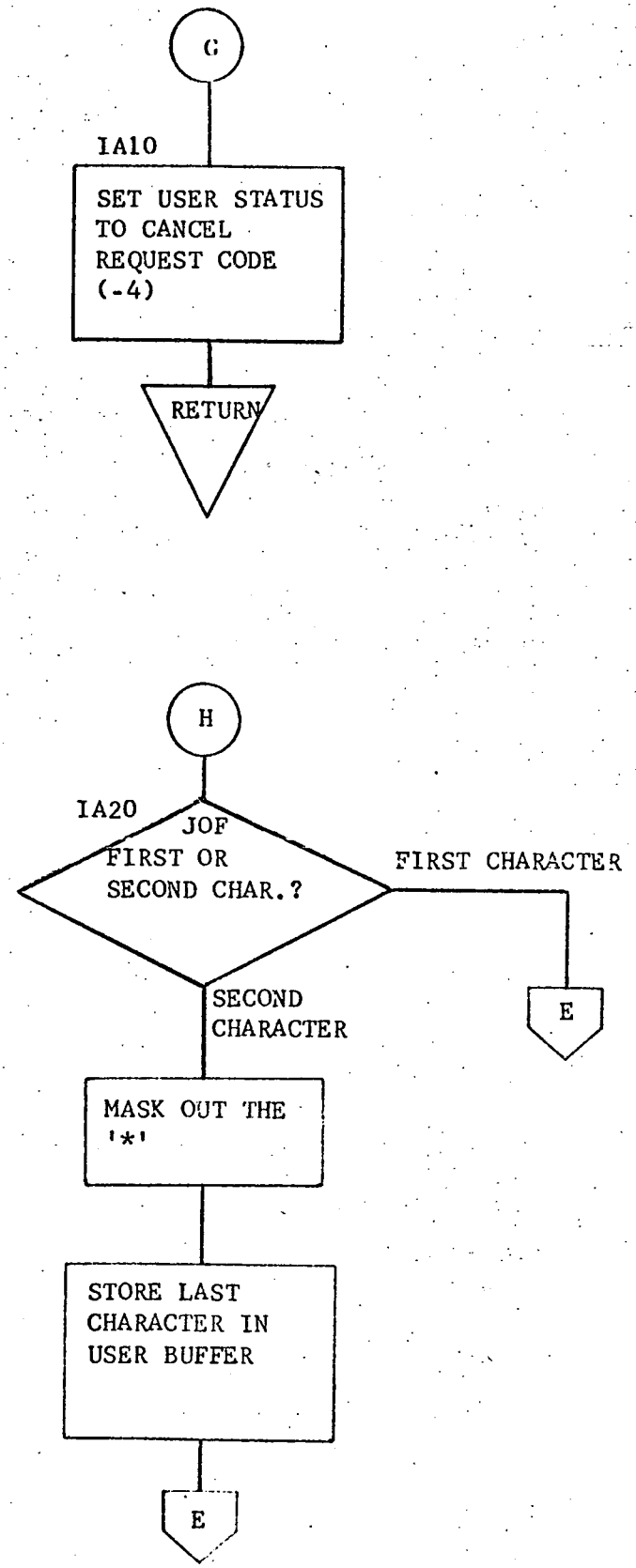
3.3.12.4 Detailed Flow Chart



OVERFLOW INDICATOR IS USED FOR INDICATING WHICH HALF OF PACK WORD IS BEING PROCESSED.


C
CANCEL REQUEST CHAR.? (@)
YES
G
NO
JOF FIRST OR SECOND CHAR. OF PACK WORD?
FIRST CHAR.
D
SECOND CHAR.
STORE PACKED INPUT WORD INTO USER BUFFER
INCREMENT BUFFER ADDRESS
INCREMENT CHARACTER COUNT
MAX. CHAR. COUNT INPUT?
YES
E
NO
A


D
SHIFT INPUT CHARACTER INTO LEFT HALF OF B
INCREMENT CHARACTER COUNT
MAX. NUMBER OF CHAR. INPUT?
NO
B
E
YES
IAA2
SET USER STATUS TO INPUT CHAR. COUNT
RETURN
F
IAA8
SET USER STATUS TO CANCEL LINE CODE (-3)
RETURN


C
IA10
SET USER STATUS TO CANCEL REQUEST CODE (-4)
RETURN
H
IA20
JOF FIRST OR SECOND CHAR.?
FIRST CHARACTER
E
SECOND CHARACTER
MASK OUT THE '*'
STORE LAST CHARACTER IN USER BUFFER
E

3.3.13 IM00 - Input Message

3.3.13.1 Purpose

The purpose of the Input Message Routine is to provide MDTRS with a generalized input routine which will service all input message requests regardless of the specific hardware configuration in which MDTRS is operating.

3.3.13.2 Technical Description

IM00 is designed to require a common calling sequence for input message requests. IM00 serves as an interface (or link) to the specific I/O handler which has been assigned by the Initialize System (IS00) Routine. The common arguments passed to IM00 by the calling program are converted by IM00 to the proper calling sequence required by the specific I/O handler.

IM00 utilizes a table (IMDT) which contains the addresses of 'set up' processing to be done for each particular I/O handler. The device code (IMDC) is used to index into the IMDT table to obtain the address of the 'set up' processing for each I/O handler. After the appropriate handler has been called, IM00 does not regain control until either the input character count has been satisfied or a terminating condition has been detected by the I/O handler. The I/O handler may return control to the user for concurrent processing while the I/O is taking place. See the individual I/O handler documentation for specific input processing. When IM00 regains control it returns control to the calling program.

This status word will be initialized by the specific handler to (-1) as soon as the first input command is issued. As soon as the first character is received by the computer, the status word is changed to (-2). If a cancel line character ($) is received, a (-3) will be set in the status word. If a cancel request character (@) is received, a (-4) will be returned. Refer to the calling sequence for additional error codes to be implemented at a later date.

If an input complete code (*) is received by the I/O handler or the maximum number of characters to be input is reached, the operation status word will be changed to a positive value indicating the number of data characters which have been placed in the user specified buffer.

The special characters: Carriage Return (CR), Line Feed (LF), Asterisk (*), Dollar Sign ($), at sign (@), EOM, LINE or END are not placed in the user's buffer but are echoed back to the output device by the assigned I/O handler. This status word address, in addition to the beginning address of the input buffer, address of character count, and address of cursor position word if required, is defined in IM00 but used by the individual I/O handlers.

3.3.13.2.1 Calling Sequence

```
CALL   IM00, A,B,C,D
```

PARAMETER	FUNCTION
A	The beginning address where the message is to be stored. (Packed two characters per word.)
B	The address of a word containing the maximum number of characters to be accepted as input.
C	Always zero (0).
D	The address of an operation status word.

The status returned by the input message routine IM00 will be as follows:

Positive value = Input complete. The value of the positive number will be the number of characters received. (May be zero if no data characters are transmitted but operation is complete.)

-1 = Input initiated - first character not received yet.

-2 = Input initiated - first character received.

-3 = Cancel line character ($) received.

-4 = Cancel request character (@) received.

-5 = Parity error (can character) (CRT only)

-6 = 103 modem disconnected.

-7 = CRT not ready.

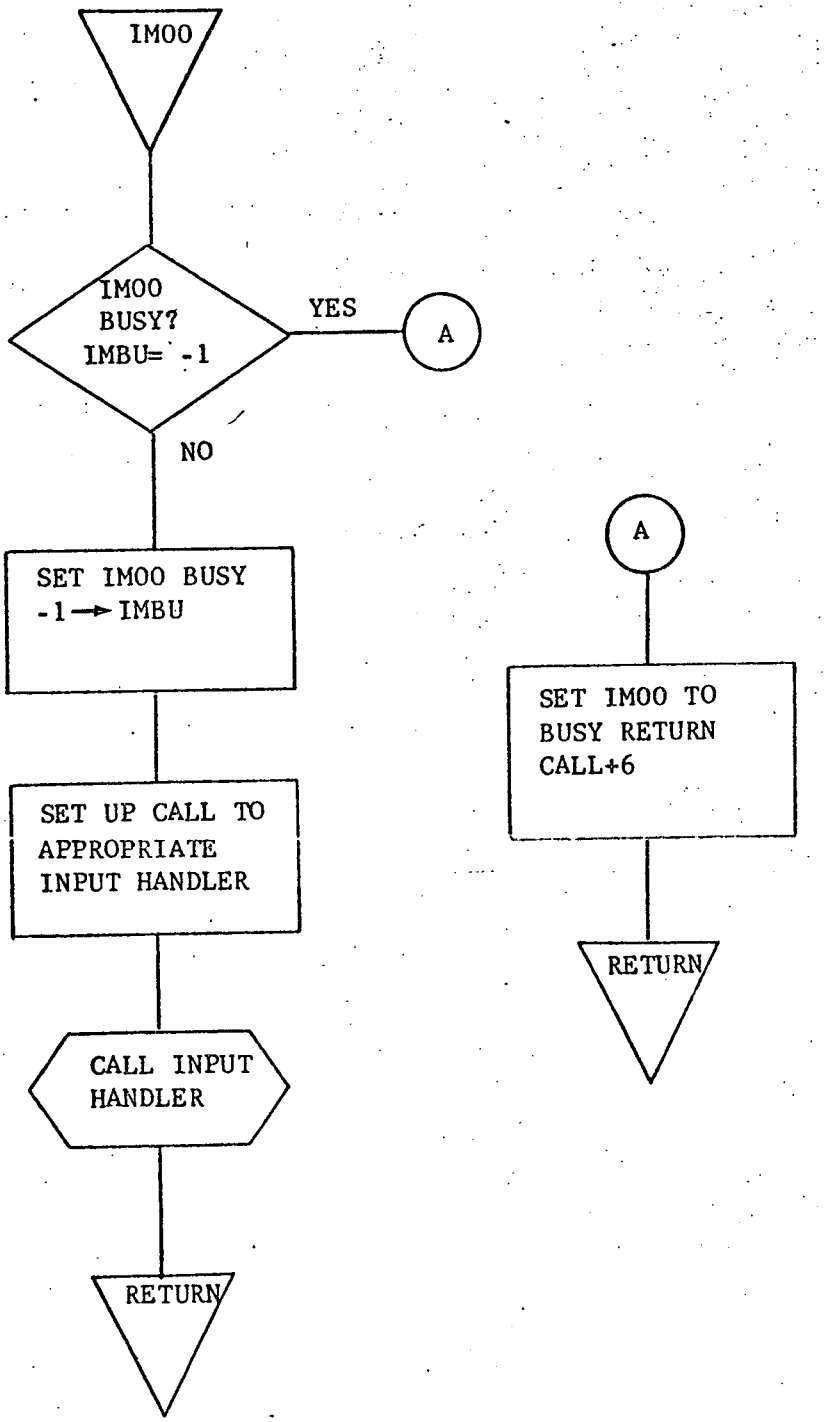
The return addresses will be as follows:

CALL+6 = previous I/O still in progress.

CALL+8 = I/O initiated. User must check operation status word at this point.

REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	Saved	Restored
B	Saved	Restored
X	Saved	Restored
Overflow	Unknown	Modified

3.3.13.2.2 General Flow Chart



3.3.13.3 Label Description

3.3.13.3.1 Local

IMA A-Register Save Area

IMB B-Register Save Area

IMBU Busy indicator for IM00 Routine (IMBU = -1 for Busy)

IMDT Table containing address of set up processing for each individual Input Handler call.

IMX X-Register Save Area

IM05 Address of call to TTY or Modem Input Handler. Used to initialize calling parameters.

3.3.13.3.2 Global

IMBA Beginning Address of Input Buffer (Referenced by Input Handler)

IMCC Address of Input Character Count (Referenced by Input Handler)

IMCP Address of Cursor Position Word if required (Referenced by Input Handler)

IMDC Device code. Set by IS00.

IMOS Address of Operation Status Word (Referenced by Input Handler)

3.3.13.3.3 Entry Points

IM00

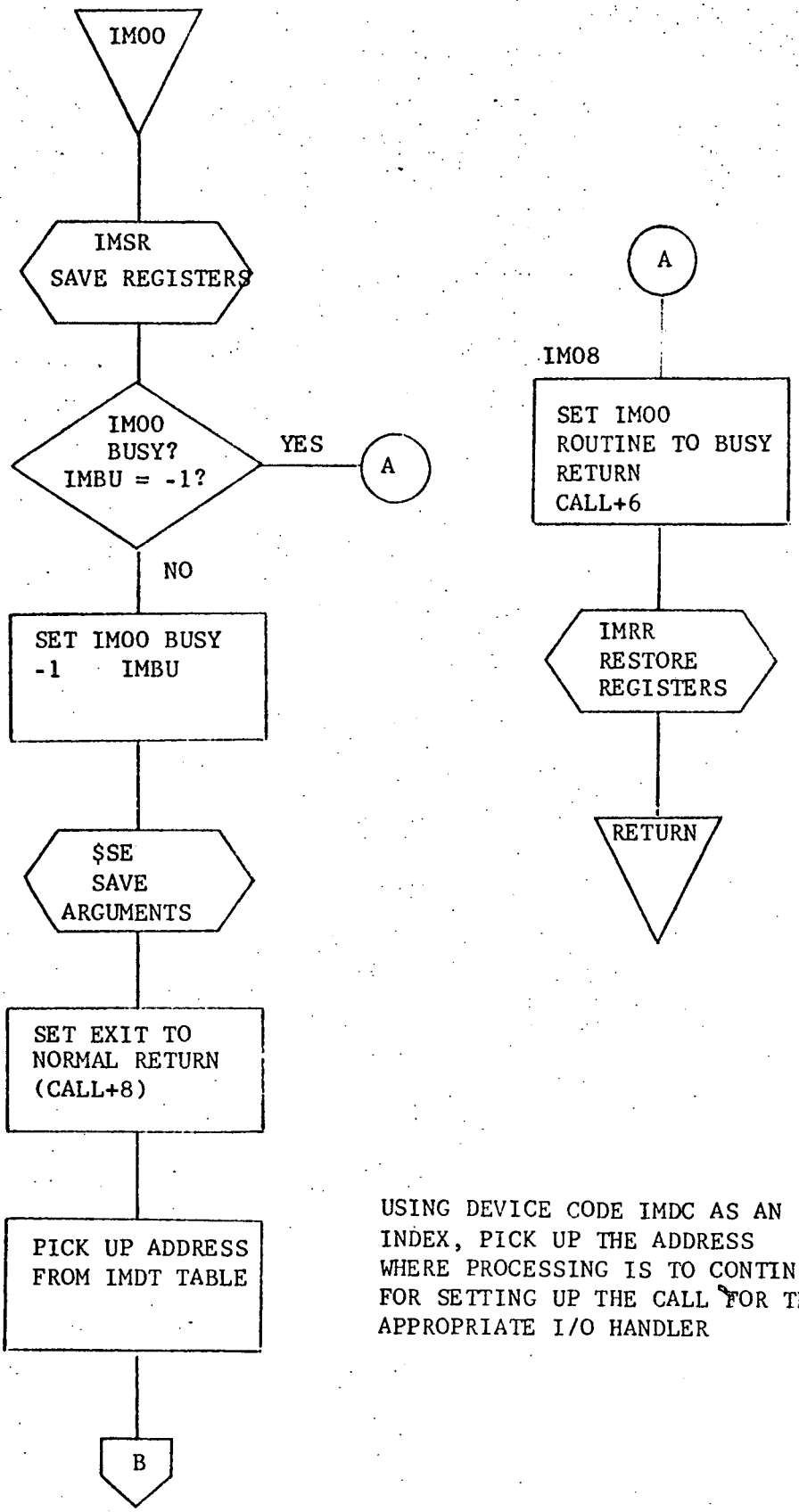
IMSR - Entry point for Saving Registers. Called by Output Message Routine (OM00).

IMRR - Entry point for Restoring Registers. Called by Output Message Routine (OM00).

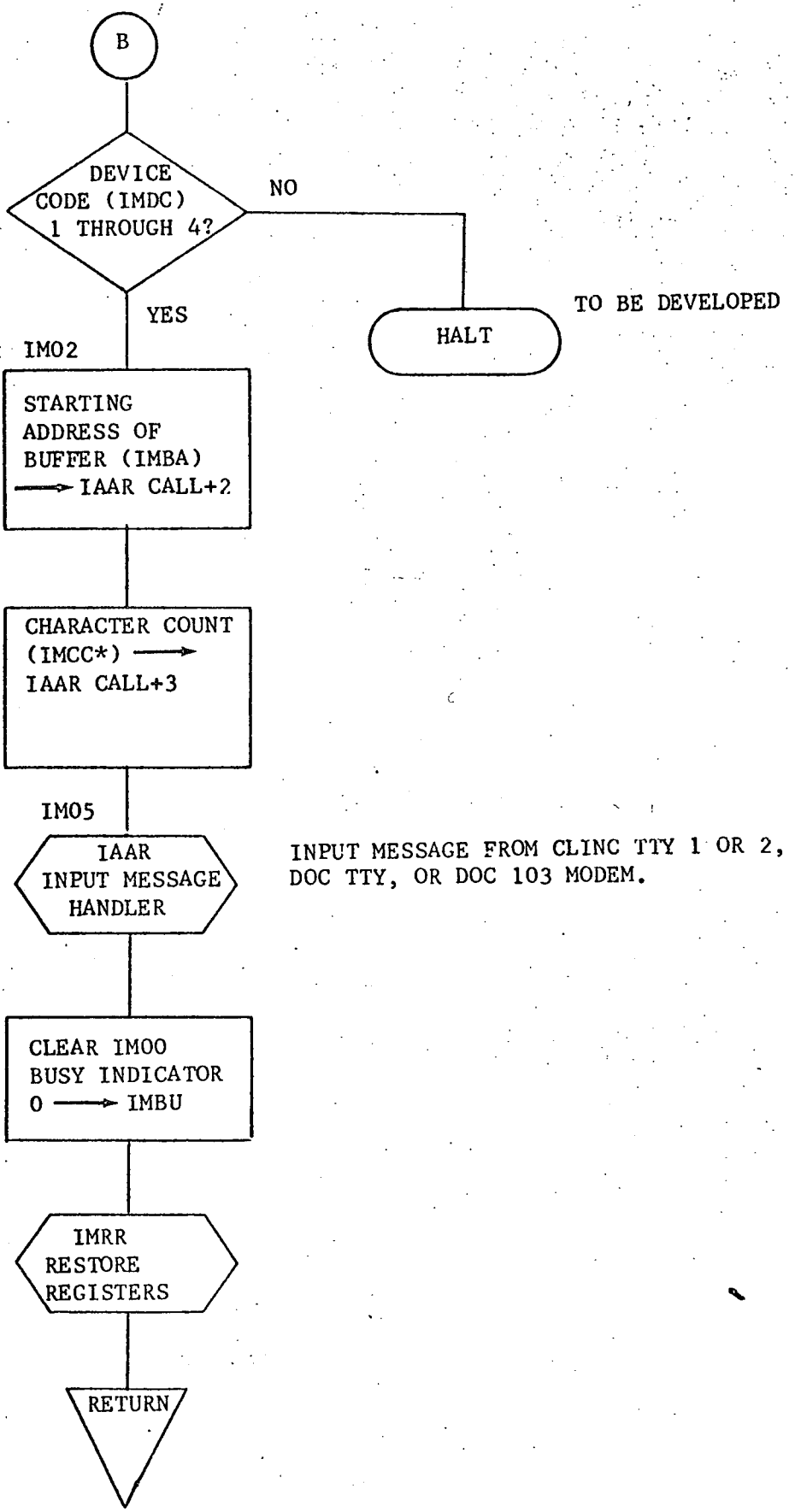
3.3.13.3.4 External References

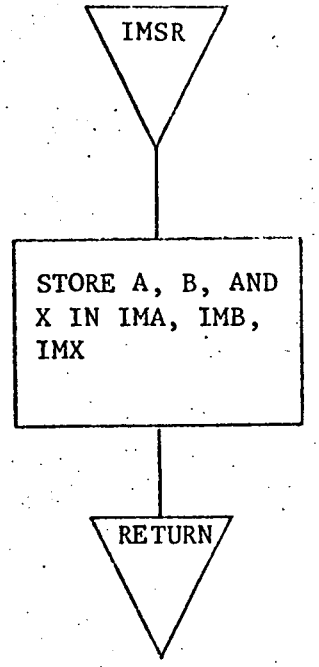
IAAR - Input handler for both CLINC TTY's, DOC TTY, and DOC 103 Modem.

3.3.13.4 Detailed Flow Chart

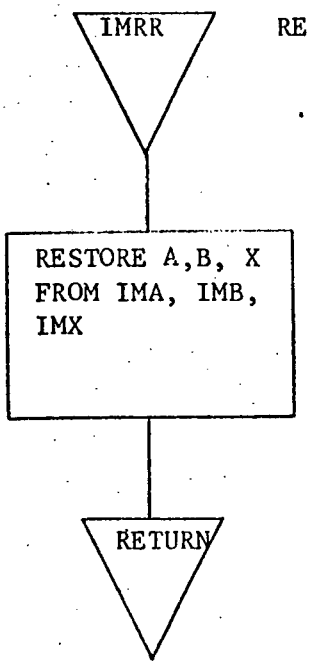


USING DEVICE CODE IMDC AS AN INDEX, PICK UP THE ADDRESS WHERE PROCESSING IS TO CONTINUE FOR SETTING UP THE CALL FOR THE APPROPRIATE I/O HANDLER


B
DEVICE CODE (IMDC) 1 THROUGH 4?
NO
YES
HALT
TO BE DEVELOPED
IM02
STARTING ADDRESS OF BUFFER (IMBA) ⟶ IAAR CALL+2
CHARACTER COUNT (IMCC*) ⟶ IAAR CALL+3
IM05
IAAR INPUT MESSAGE HANDLER
INPUT MESSAGE FROM CLINC TTY 1 OR 2, DOC TTY, OR DOC 103 MODEM.
CLEAR IM00 BUSY INDICATOR 0 ⟶ IMBU
IMRR RESTORE REGISTERS
RETURN



SAVE REGISTERS



RESTORE REGISTERS

3.3.14 ISOO - Initialize System

3.3.14.1 Purpose

The primary purpose of the ISOO subroutine is to permit the same MDTRS object program to operate for various configurations on various computer systems. This capability eliminates the tedious, costly, and sometimes confusing task of maintaining many "configuration tailored" object programs, operating instructions, and program documentation. ISOO accomplishes this by initializing all input/output routines with the operator requested configuration device numbers and device dependent coding.

3.3.14.2 Technical Description

The ISOO routine requires the operator to type in a description of the configuration that MDTRS must satisfy. Refer to the Users Guide for specific computer/operator dialogue. ISOO types the code numbers and instructions on the operator console before requiring the operator to answer questions about the configuration. ISOO contains tables of device numbers, PIM numbers, interrupt masks, and interrupt locations associated with each computer system and each I/O device. In addition, tables containing I/O instruction addresses in each of the I/O handlers are maintained so that those instructions may be modified if necessary. These tables are used to set up the appropriate I/O handlers with proper device numbers, PIM numbers, etc. ISOO initializes the Input Message Routine (IMOO) and the Output Message Routine (OMOO) to call the appropriate handlers based upon the requested hardware configuration.

All inputs from the operator are checked for validity. The operator is required to assign the tape unit number for the Master Data Tape and HC00 verifies that the tape is on-line. In addition, HC00 initializes the 103 modem and waits for a telephone connection if it is part of the requested configuration.

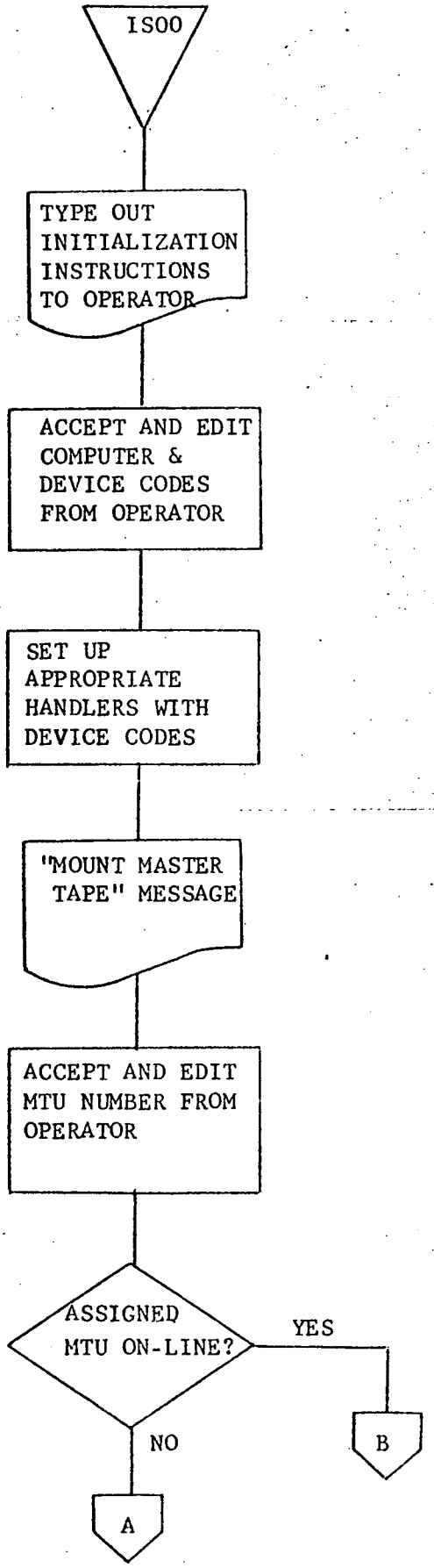
3.3.14.2.1 Calling Sequence

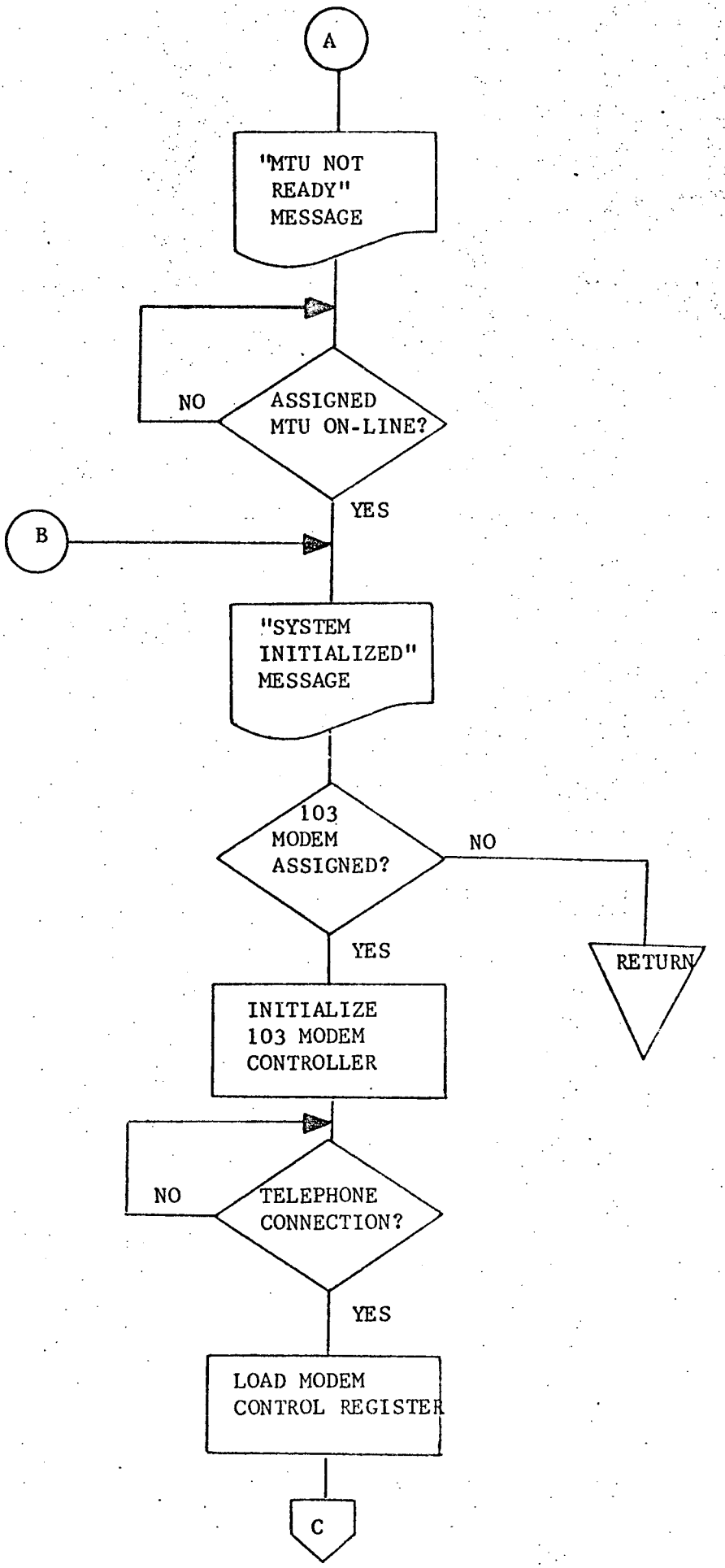
CALL IS00

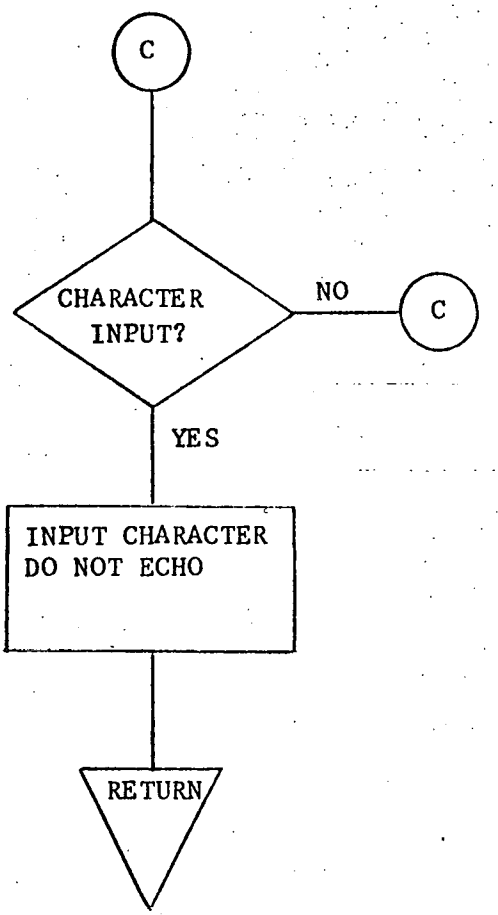
PARAMETER	FUNCTION
None	

REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	N/A	Modified
B	N/A	Modified
X	N/A	Modified
Overflow	N/A	Modified

3.3.14.2.2 General Flow Chart




A
"MTU NOT READY" MESSAGE
NO
ASSIGNED MTU ON-LINE?
YES
B
"SYSTEM INITIALIZED" MESSAGE
103 MODEM ASSIGNED?
NO
RETURN
YES
INITIALIZE 103 MODEM CONTROLLER
NO
TELEPHONE CONNECTION?
YES
LOAD MODEM CONTROL REGISTER
C


C
CHARACTER INPUT?
NO
C
YES
INPUT CHARACTER
DO NOT ECHO
RETURN

3.3.14.3 Label Description

3.3.14.3.1 Local

ISCC Temporary location for computer code. (for future use only)

ISDT Table containing actual computer device codes associated with device code numbers used by IS00 to communicate with the operator.

ISD3 Table of addresses which must have device number placed in them for TTY and 103 Modem I/O.

ISHT Table of addresses where table of addresses for modifying each handler can be found.

ISNW Number of words in ISTM buffer used for TTY call.

ISN1 Number of words in ISQ1 buffer - used for TTY call.

ISN2 Number of words in ISQ2 message buffer.

ISN3 Number of words in ISQ3.

ISN4 Number of words in ISQ4.

ISN5 Number of words in ISQ5.

ISQ1 "WHAT COMPUTER" message buffer.

ISQ2 "PRIMARY RETRIEVAL DEVICE" message buffer.

ISQ3 "MOUNT MASTER TAPE" message buffer.

ISQ4 "SYSTEM INITIALIZED" message buffer.

ISQ5 "MTU NOT READY" message buffer.

ISTM "INITIALIZE SYSTEM" message buffer.

IST1 "ILLEGAL CODE" message buffer.

IST2 Number of words in IST1

ISZZ End Flag for Device instruction address table (ISD3).

IS3B Location where "SENSE MTU READY" instruction is initialized.

IS14+1 Indirect address of instruction to receive device number.

IS20+1 Indirect address of instruction to receive device number.

IS31 Location where "SENSE MTU READY" instruction is initialized.

IS35 TTY or 103 modem instruction requiring device number to be initialized.

IS37 TTY or 103 modem instruction requiring device number to be initialized.

IS40 TTY or 103 modem instruction requiring device number to be initialized.

IS44 TTY or 103 modem instruction requiring device number to be initialized.

IS48 TTY or 103 modem instruction requiring device number to be initialized.

IS52 TTY or 103 modem instruction requiring device number to be initialized.

IS54 TTY or 103 modem instruction requiring device number to be initialized.

IS92 Output buffer address used by output operator message (IS90).

3.3.14.3.2 Global

CPUN Equated to ISTU.

ISN6 Number of words in ISQ6. Referenced by PF00.

ISQ6 "PUT MAG TAPE ON LINE" message buffer. Referenced by Power Fail Routine (PF00).

ISTU Tape unit number. To be used by any call to the mag tape handler (HM00).

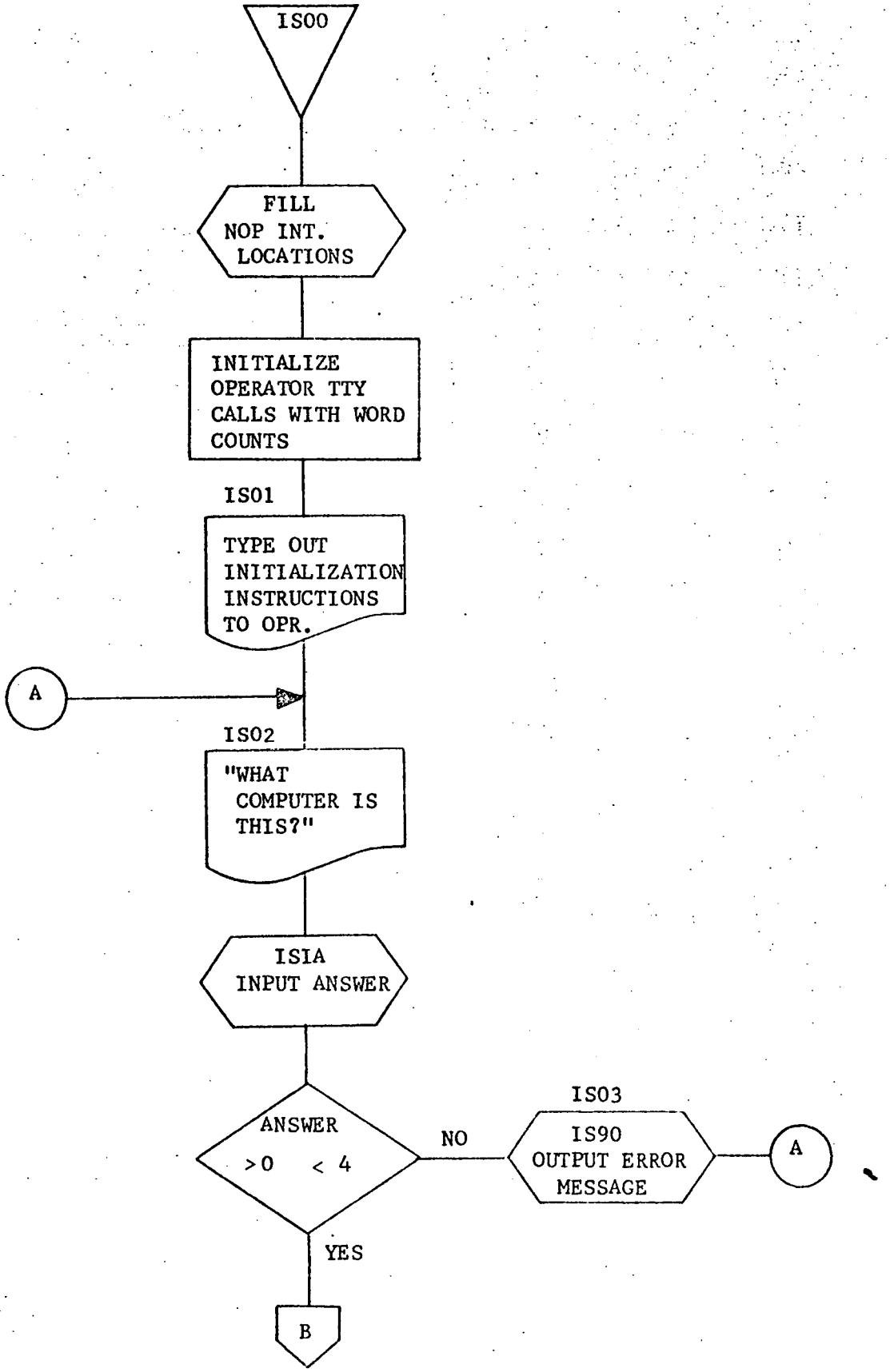
3.3.14.3.3 Entry Points

IS00

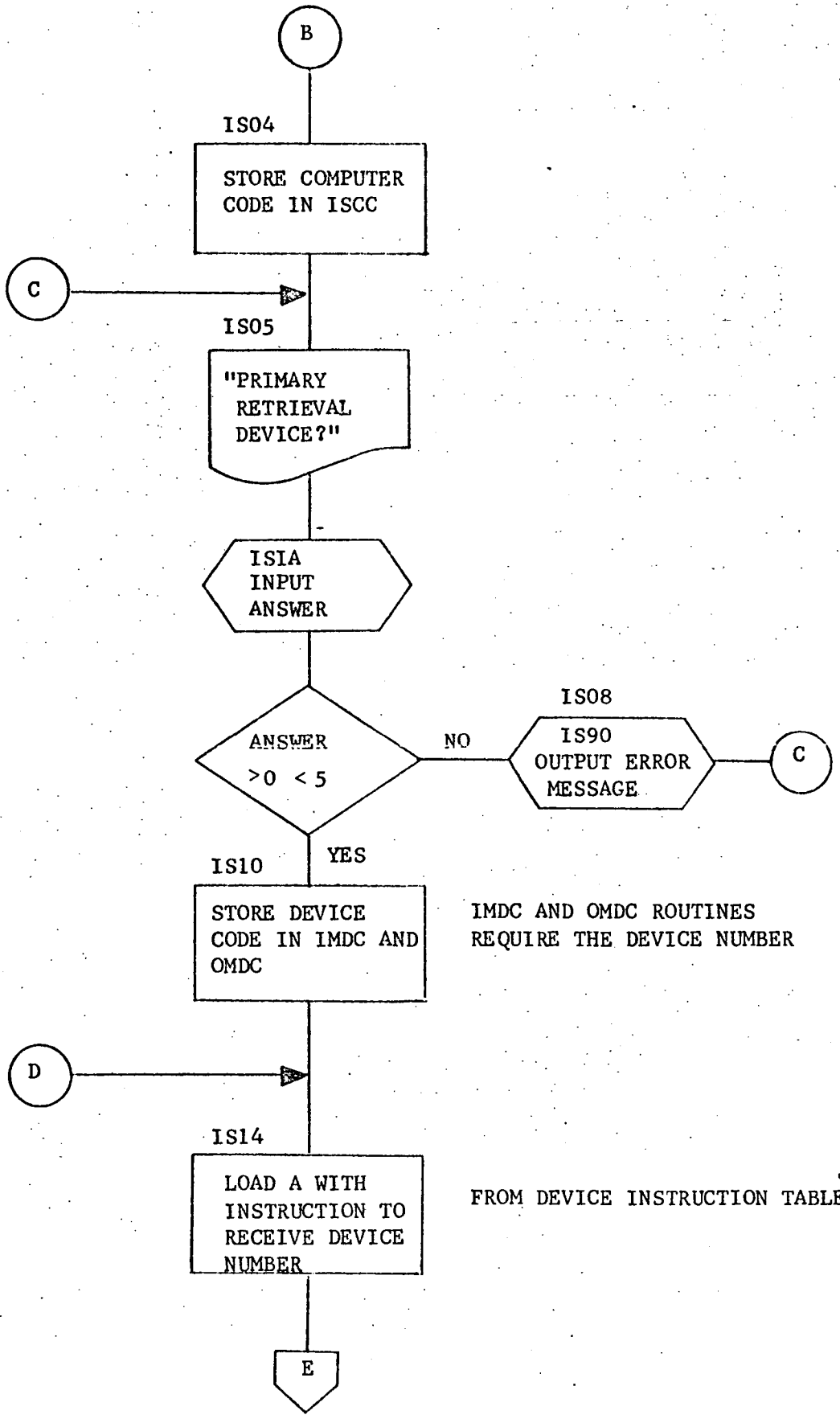
3.3.14.3.4 External References

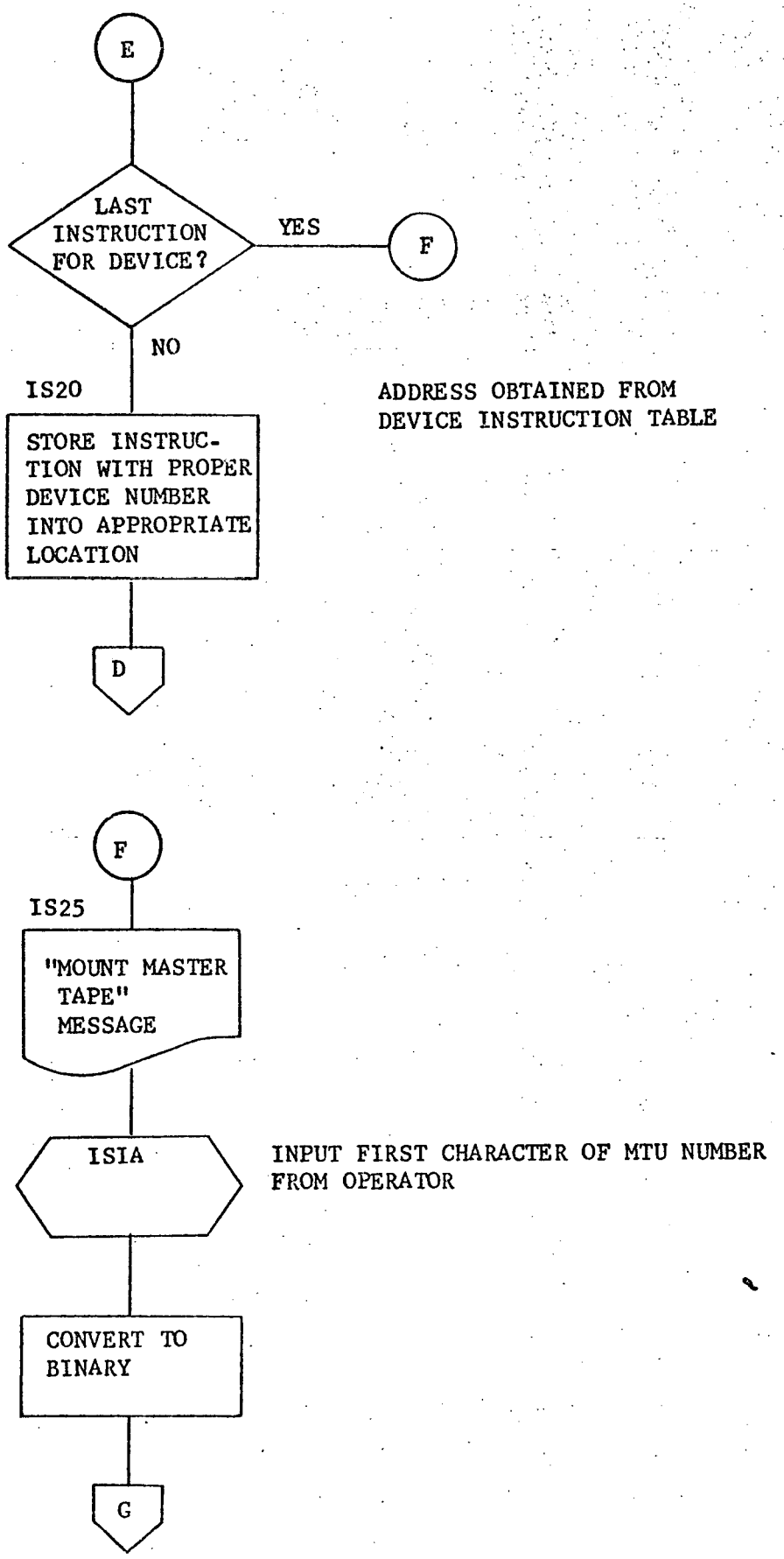
CPC1	TTY or 103 Modem instruction requiring device number to be initialized.
CPC2	TTY or 103 Modem instruction requiring device number to be initialized.
ISB2	TTY or 103 Modem instruction requiring device number to be initialized.
ISB3	TTY or 103 Modem instruction requiring device number to be initialized.
OZK2	TTY or 103 Modem instruction requiring device number to be initialized.
OZK3	TTY or 103 Modem instruction requiring device number to be initialized.
OZK4	TTY or 103 Modem instruction requiring device number to be initialized.
OZK5	TTY or 103 Modem instruction requiring device number to be initialized.
OZN2	TTY or 103 Modem instruction requiring device number to be initialized.
OZW1	TTY or 103 Modem instruction requiring device number to be initialized.

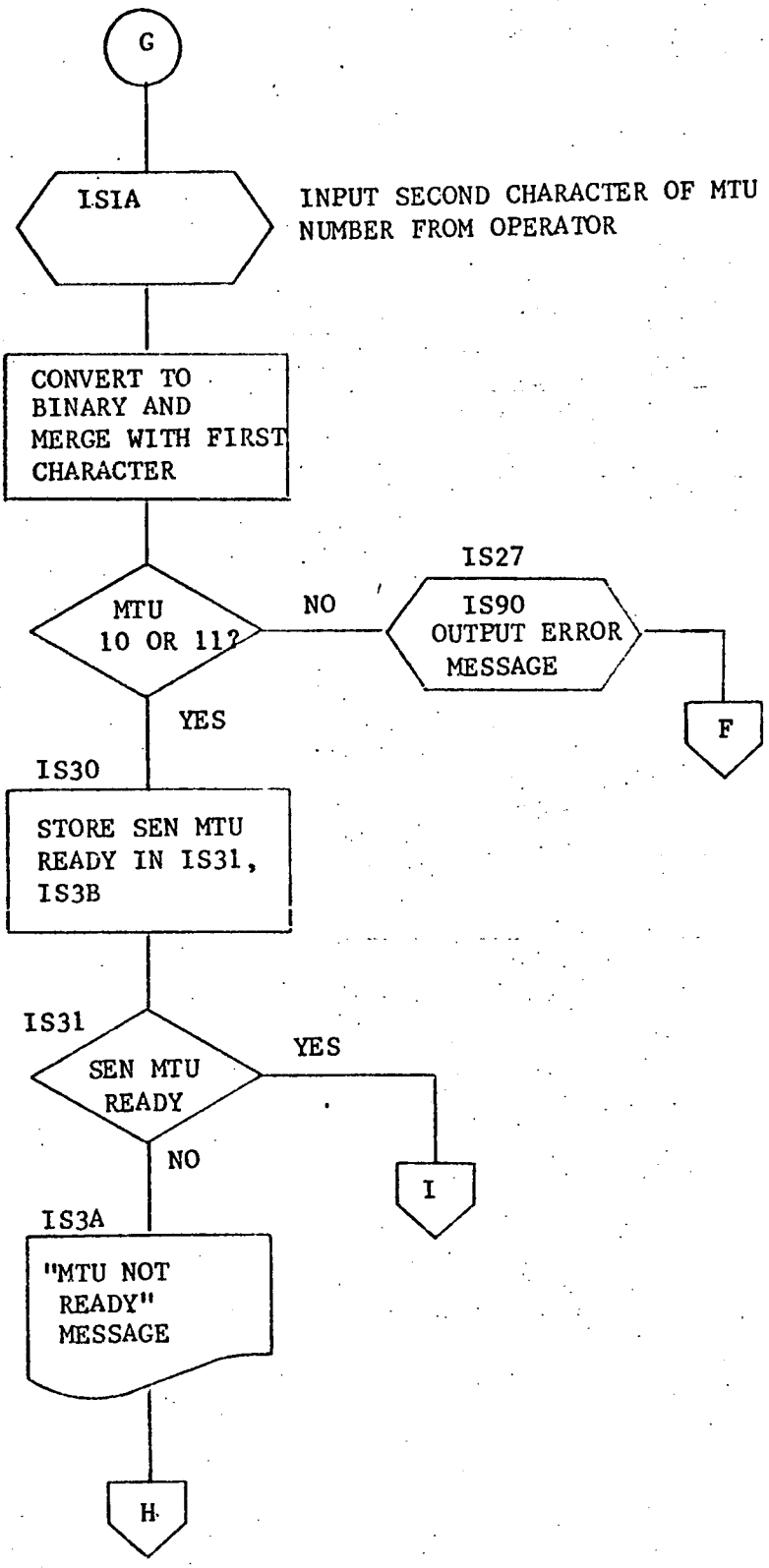
3.3.14.4 Detailed Flow Chart

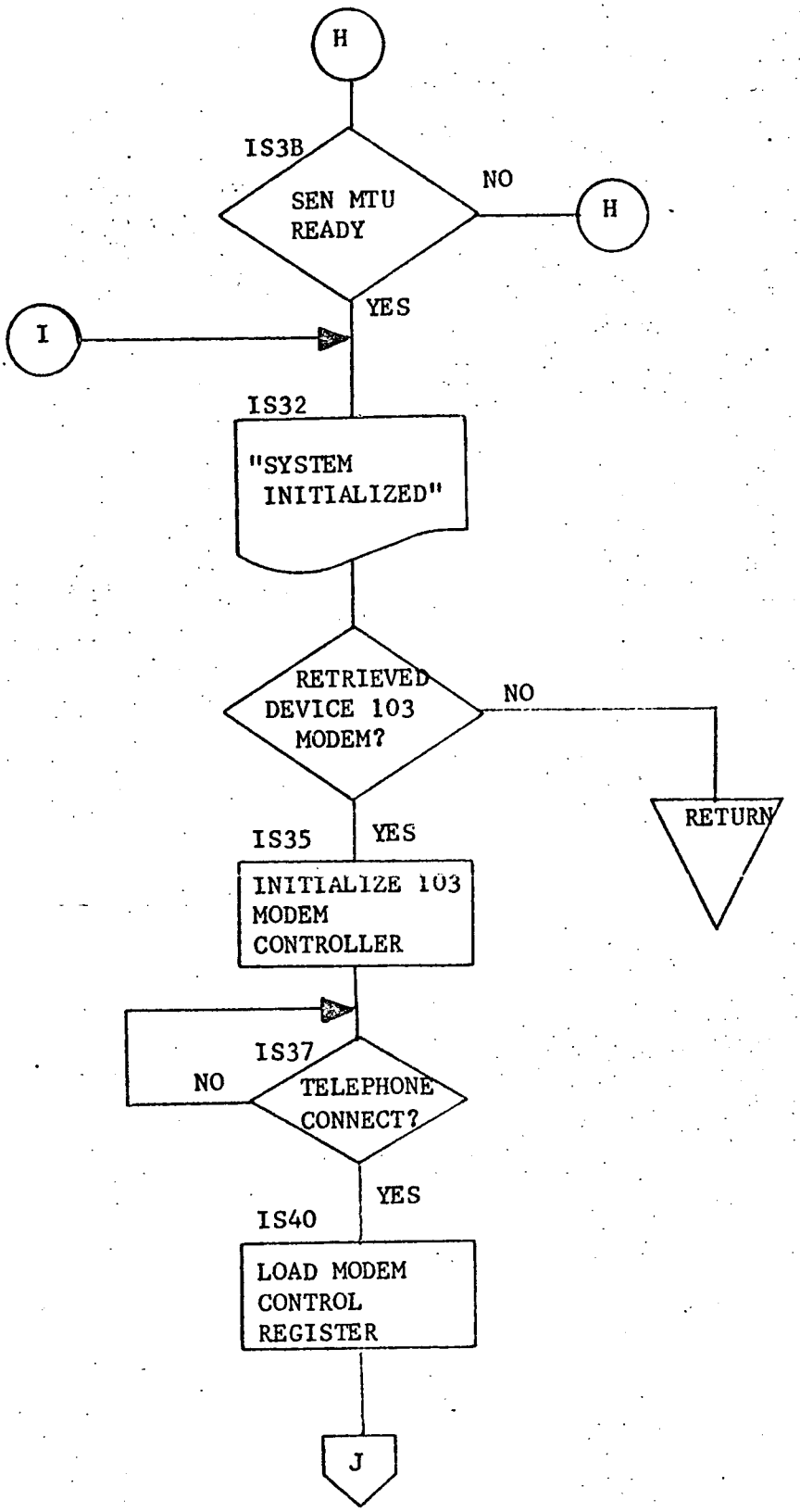


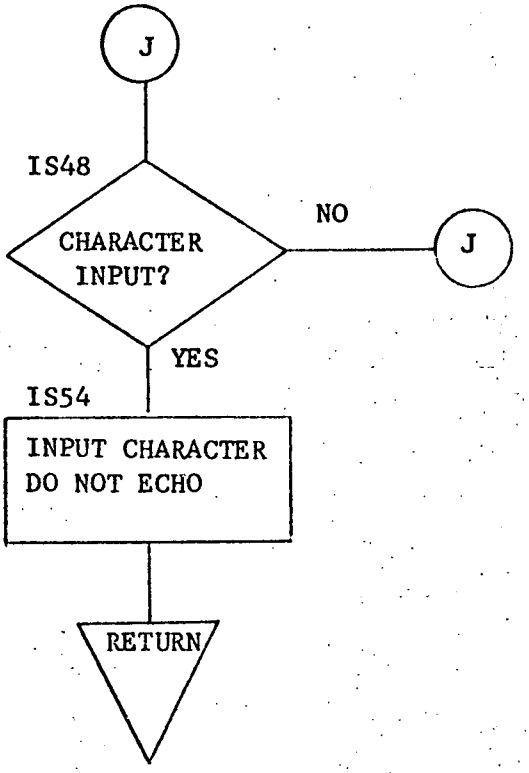
4A

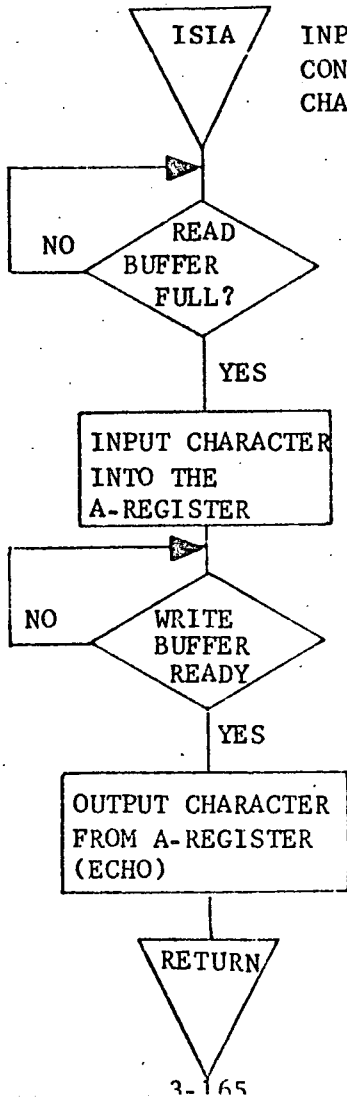

B
IS04
STORE COMPUTER CODE IN ISCC
C
IS05
"PRIMARY RETRIEVAL DEVICE?"
ISIA INPUT ANSWER
ANSWER >0 <5
NO
IS08
IS90 OUTPUT ERROR MESSAGE
C
YES
IS10
STORE DEVICE CODE IN IMDC AND OMDC
IMDC AND OMDC ROUTINES REQUIRE THE DEVICE NUMBER
D
IS14
LOAD A WITH INSTRUCTION TO RECEIVE DEVICE NUMBER
FROM DEVICE INSTRUCTION TABLE
E


E
LAST INSTRUCTION FOR DEVICE?
YES
F
NO
IS20
STORE INSTRUC-TION WITH PROPER DEVICE NUMBER INTO APPROPRIATE LOCATION
ADDRESS OBTAINED FROM DEVICE INSTRUCTION TABLE
D
F
IS25
"MOUNT MASTER TAPE" MESSAGE
ISIA
INPUT FIRST CHARACTER OF MTU NUMBER FROM OPERATOR
CONVERT TO BINARY
G

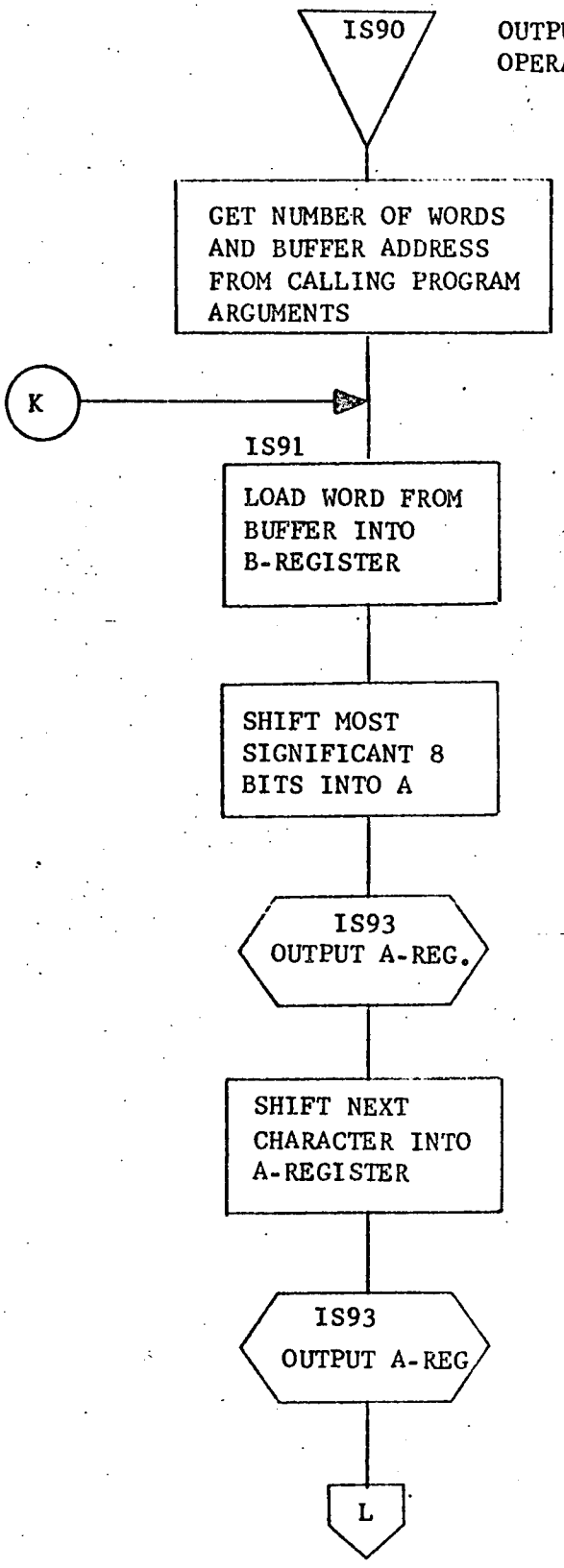

G
ISIA
INPUT SECOND CHARACTER OF MTU NUMBER FROM OPERATOR
CONVERT TO BINARY AND MERGE WITH FIRST CHARACTER
MTU 10 OR 11?
NO
IS27
IS90 OUTPUT ERROR MESSAGE
F
YES
IS30
STORE SEN MTU READY IN IS31, IS3B
IS31
SEN MTU READY
YES
I
NO
IS3A
"MTU NOT READY" MESSAGE
H

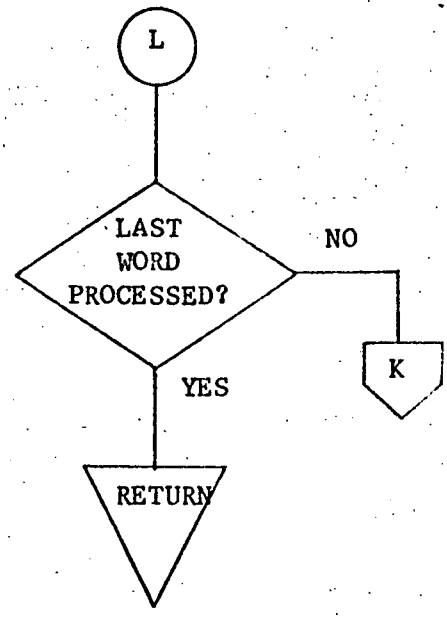

H
IS3B
SEN MTU READY
NO
H
YES
I
IS32
"SYSTEM INITIALIZED"
RETRIEVED DEVICE 103 MODEM?
NO
RETURN
IS35
YES
INITIALIZE 103 MODEM CONTROLLER
IS37
NO
TELEPHONE CONNECT?
YES
IS40
LOAD MODEM CONTROL REGISTER
J





INPUT ONE CHARACTER FROM OPERATOR CONSOLE. (STANDARD DEVICE 1)
CHARACTER RETURNED IN A-REGISTER


IS90
OUTPUT N NUMBER OF WORDS TO THE OPERATOR"S CONSOLE (STANDARD DEVICE 1)
GET NUMBER OF WORDS AND BUFFER ADDRESS FROM CALLING PROGRAM ARGUMENTS
K
IS91
LOAD WORD FROM BUFFER INTO B-REGISTER
SHIFT MOST SIGNIFICANT 8 BITS INTO A
IS93
OUTPUT A-REG.
SHIFT NEXT CHARACTER INTO A-REGISTER
IS93
OUTPUT A-REG
L


L
LAST
WORD
PROCESSED?
NO
K
YES
RETURN

3.3.15 ISB1 - Input a character from KSR-35

3.3.15.1 Purpose

This routine inputs a character from the KSR-35 teletype, checks it for validity, and outputs it to the TTY. When the character is illegal it is deleted.

3.3.15.2 Technical Description

N/A

3.3.15.2.1 Calling Sequence

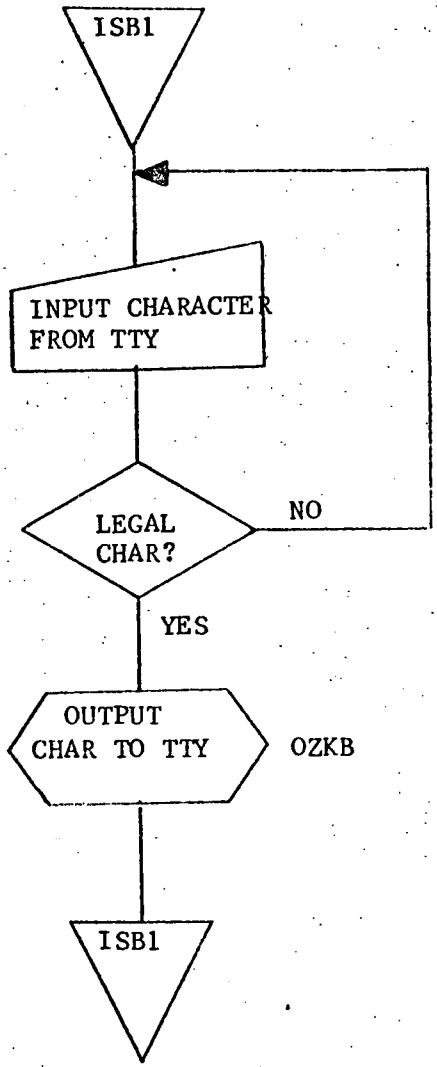
```
CALL  ISB1
```

PARAMETER

None

REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	destroyed	
B	destroyed	
X	undisturbed	
Overflow	undisturbed	

3.3.15.2.2 General Flow Chart



3.3.15.3 Label Description

3.3.15.3.1 Local

ISB5 - ASCII character mask

3.3.15.3.2 Global

None

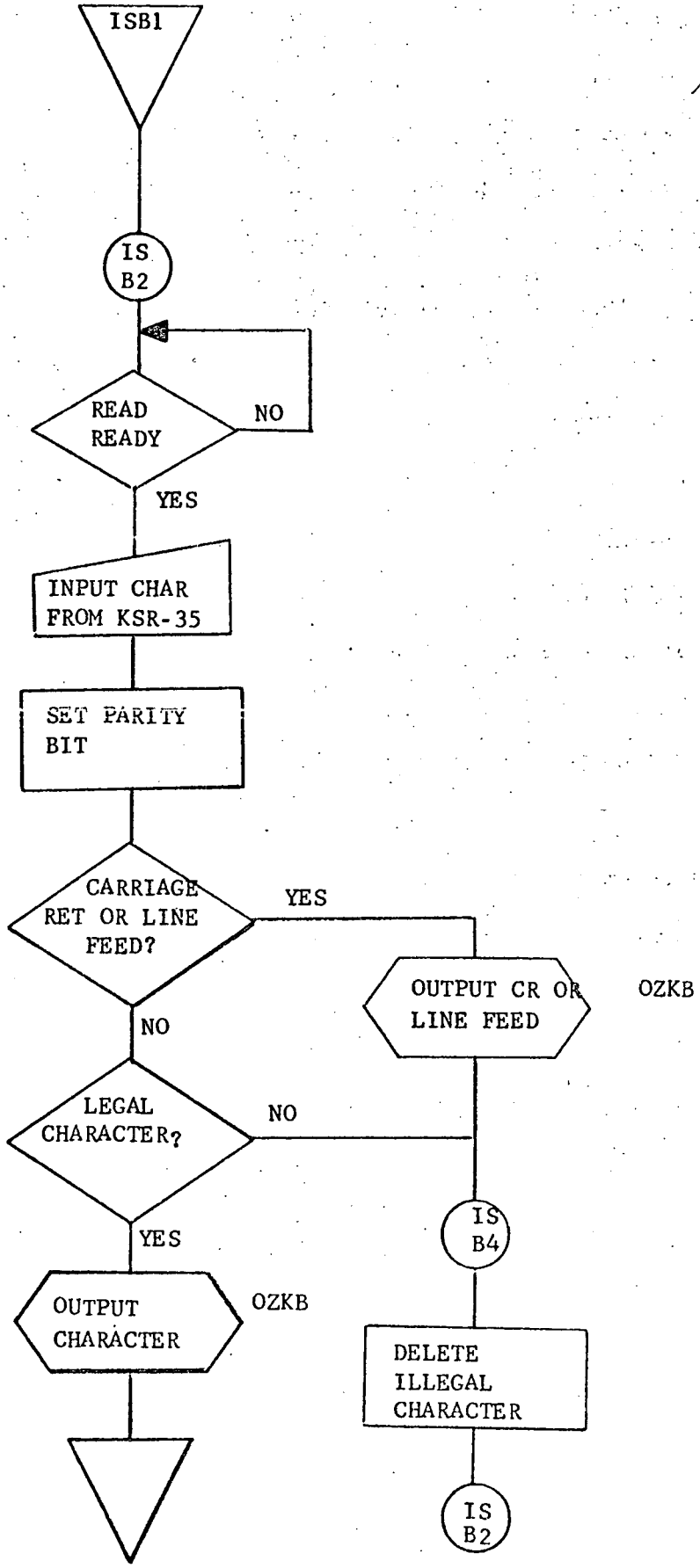
3.3.15.3.3 Entry Points

ISB1 - primary entry point

3.3.15.3.4 External References

OZKB - output one character to TTY

3.3.15.4 Detailed Flow Chart



3.3.16 LIOO - List

3.3.16.1 Purpose

The purpose of this subroutine is to format, in outline form, the data specified by the WHAT response in the Retrieval Request.

3.3.16.2 Technical Description

A match to a WHAT parameter indicates that the parameter is to be output. Both the Heading and its associated Answer are output, even if both were not specified in the Retrieval Response.

Example:

WHAT: ASTHMA

If the Heading ASTHMA is found on the record, then ASTHMA will be output as well as the Answer associated with it, which, in all probability, is either NEG or POS.

Associated with each Heading-Answer pair is a "level code". This code is a number from 0-9, and it specifies two characteristics of the Heading-Answer pair: the level of the pair in the hierarchical structure of the record format, and the relation among pairs. Each of these characteristics will have an effect on the output. The level of the pair will be shown on output by indenting each Heading a number of spaces equal to the value of the level code. The relation among Heading-Answer pairs will be indicated by outputting, in addition to the matched parameter, all those pairs related to the one matched. Example: if ASTHMA is related to the Headings PAST HX and GENERAL, then these Headings and their associated Answers should also be output.

Relation among Headings is determined in the following manner: starting at the level code of the matched Heading and proceding back through the codes, find a level code that is one less in value than the matched Headings level code. The Heading associated with this level code is related to the matched Heading. From this point, proceed backwards again until a code that is two less is found. This continues until a level code of zero has been reached. Now examine each level code forward from the matched Heading's code. If the level code is greater than the matched code, its Heading is related. When the first code less than or equal to the level code of the matched Heading is found, the search is finished.

As each Heading-Answer pair is matched by MW00 it and all related pairs are flagged for eventual output. This flagging consists of setting the word preceding the level code of each pair to -1. When the entire record has been considered, the flagged data is output. In the case of the default condition for WHAT, all data on the record is output.

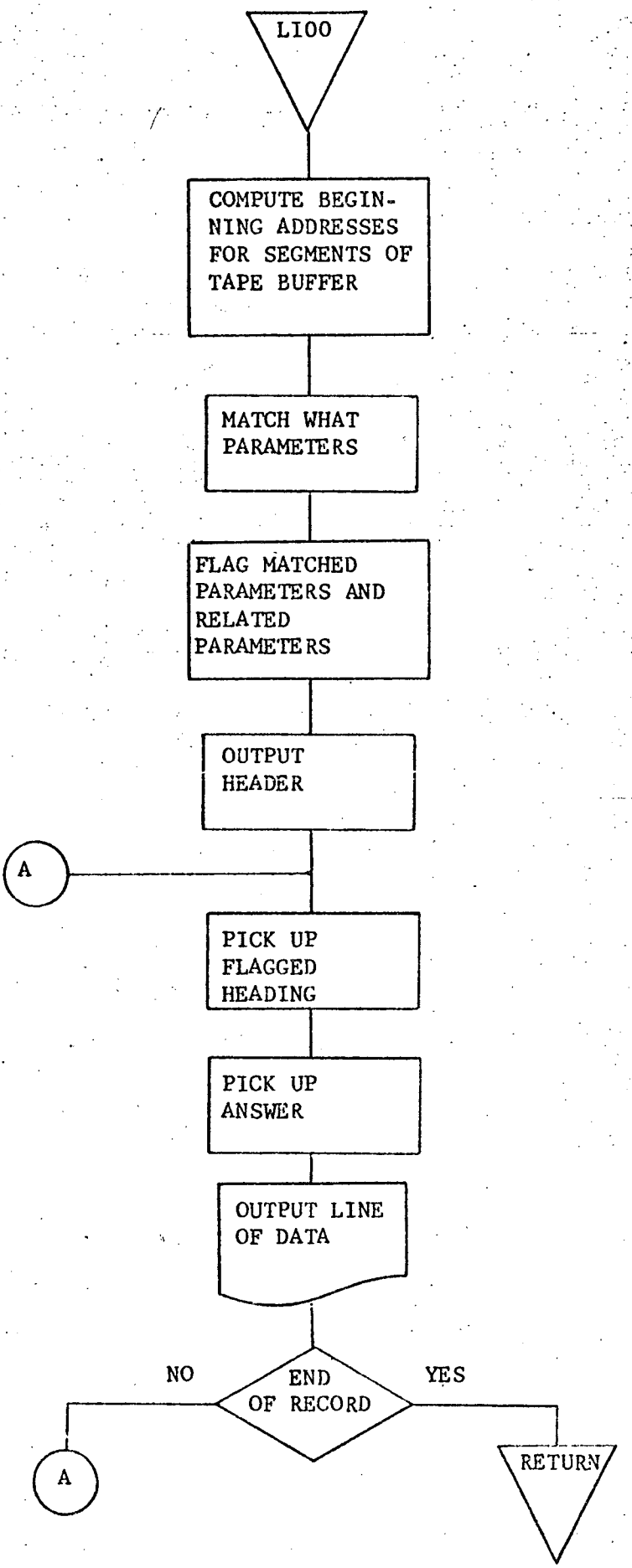
If the user input "ID ONLY" as his response to the WHAT question, only the line of data containing the ID information is output.

3.3.16.2.1 Calling Sequence

CALL LI00

REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	N/A	N/A
B	N/A	N/A
X	N/A	N/A
Overflow	N/A	N/A

3.3.16.2.2 General Flow Chart



3.3.16.3 Label Description

3.3.16.3.1 Local

LIAN beginning address in the tape buffer of the IANS section (or the section of the record containing the Answers).

LIBC blank counter. Counts the number of consecutive blanks before they are stored for output.

LIBL (40_8) blank

LICC character counter. Used to count characters in special situations (Headings, Answers)

LICL (72_8) colon

LICR (15_8) carriage return

LIEA ending address of the current Answer.

LIEQ (75_8) equal sign

LIFW beginning address in the tape buffer of the IFWAA section (or the section of the record containing the beginning addresses of the Answers).

3.3.16.3.1 Local (Continued)

LIID ID only flag. If set, indicates that the user response to WHAT was "ID ONLY."

LIIQ beginning address in the tape buffer of the IQ section (or the section of the record containing the Headings).

LILA address of the current level code

LILC the value of the current level code

LILL line character-counter. Counts the number of characters on the current line.

LILQ beginning address in the tape buffer of the LCQ section (or the section of the record containing the level codes).

LILX a dummy level code

LIQN question number. The number of the Heading-Answer pair currently being dealt with.

LIQX temporary question number. Dummy location for the question number

LISA starting address of the current Answer

LIST status word returned set by OM00 on output

3.3.16.3.1 Local (Continued)

LISV utility save location

LITB (74_8) tab character

3.3.16.3.2 Global

None

3.3.16.3.3 Entry Points

LIOO

3.3.16.3.4 External References

CDOO routine to decode the date on the record.

CPRT Request Table

CPTB Tape input buffer

MWOO routine to match responses to WHAT request, to record Headings.

OMOO routine to control output to primary output device.

PKBX beginning address of buffer into which characters are to be packed.

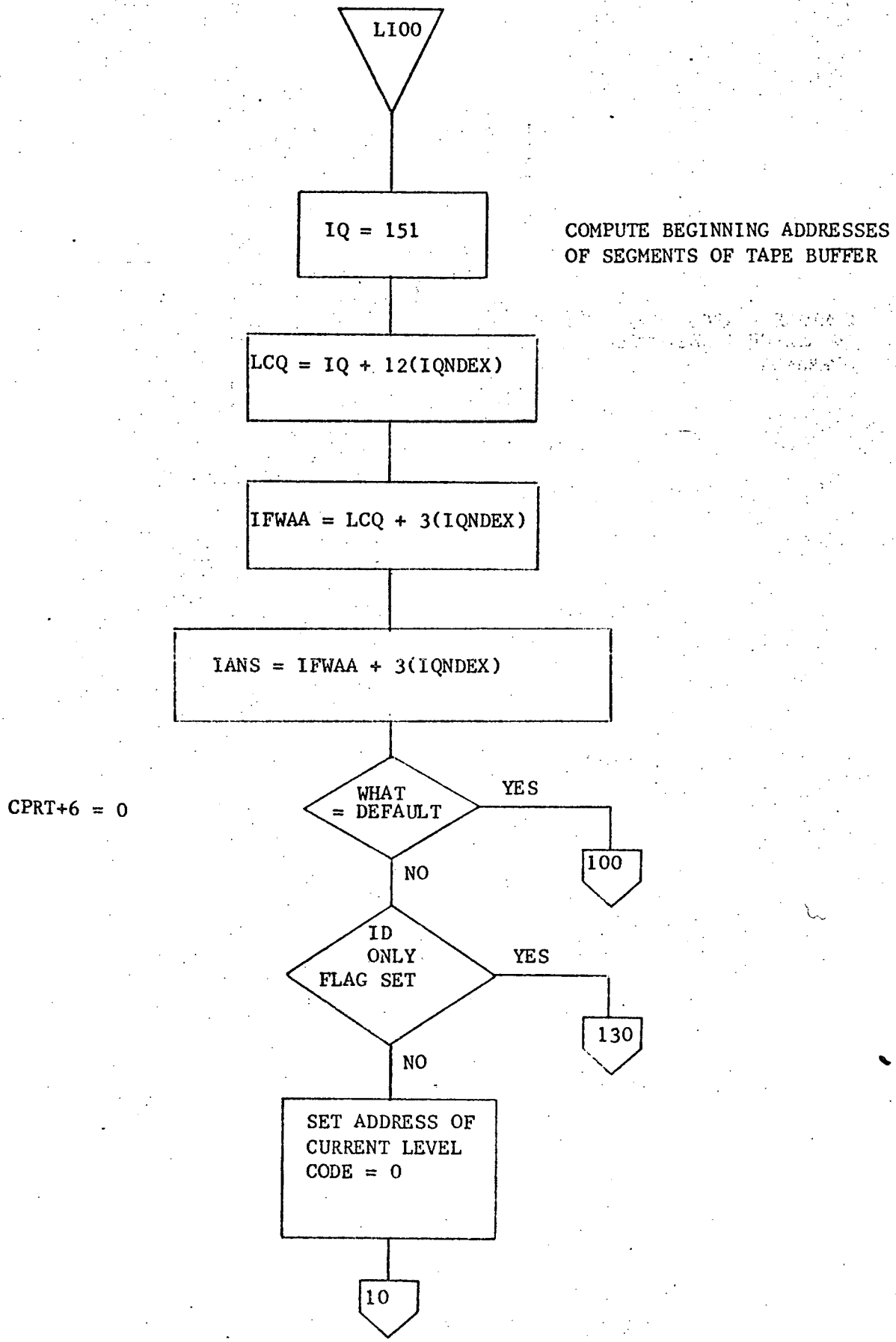
PKIX index into buffer into which characters are being packed.

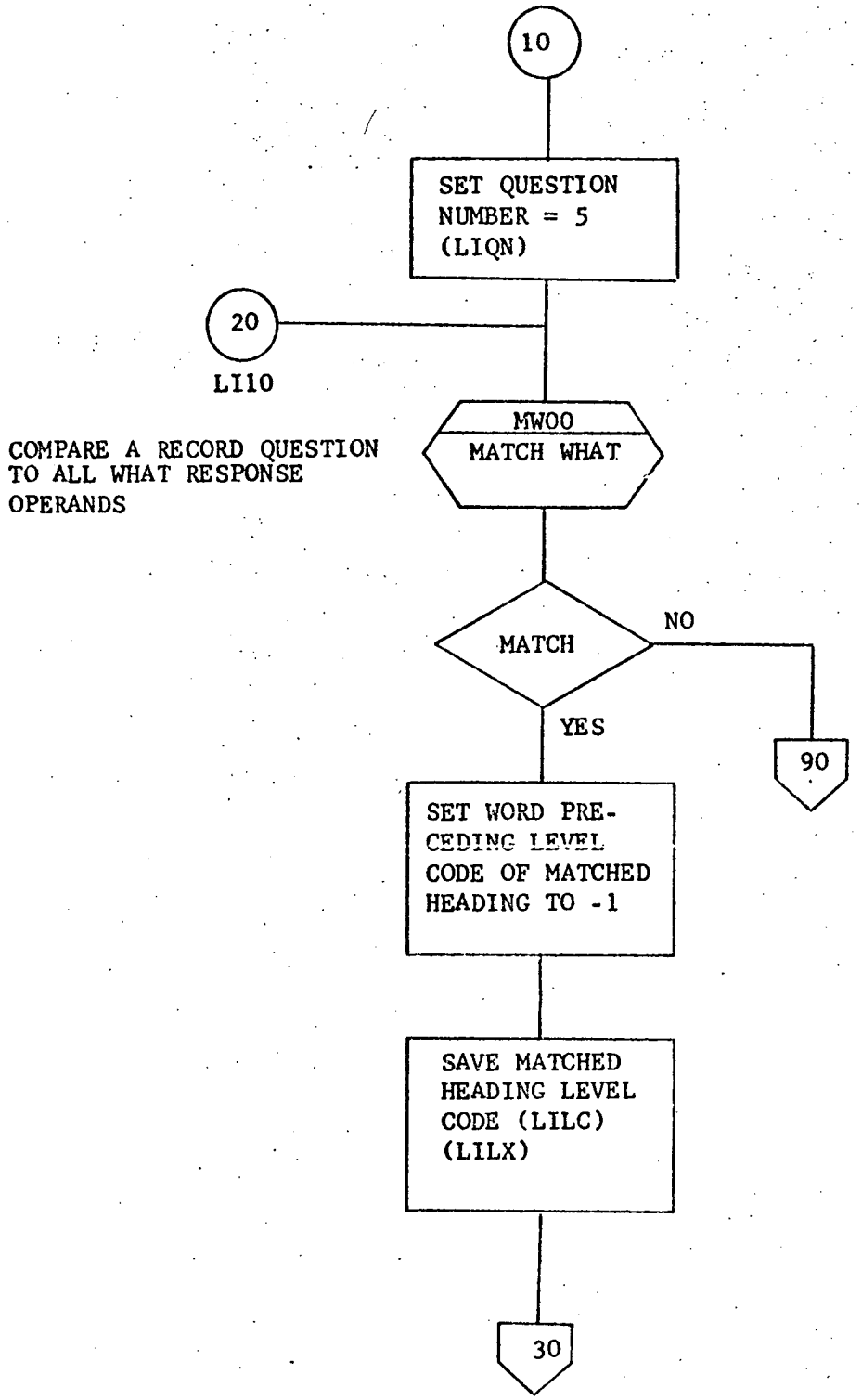
PKSW switch indicating which half of word to pack next character.

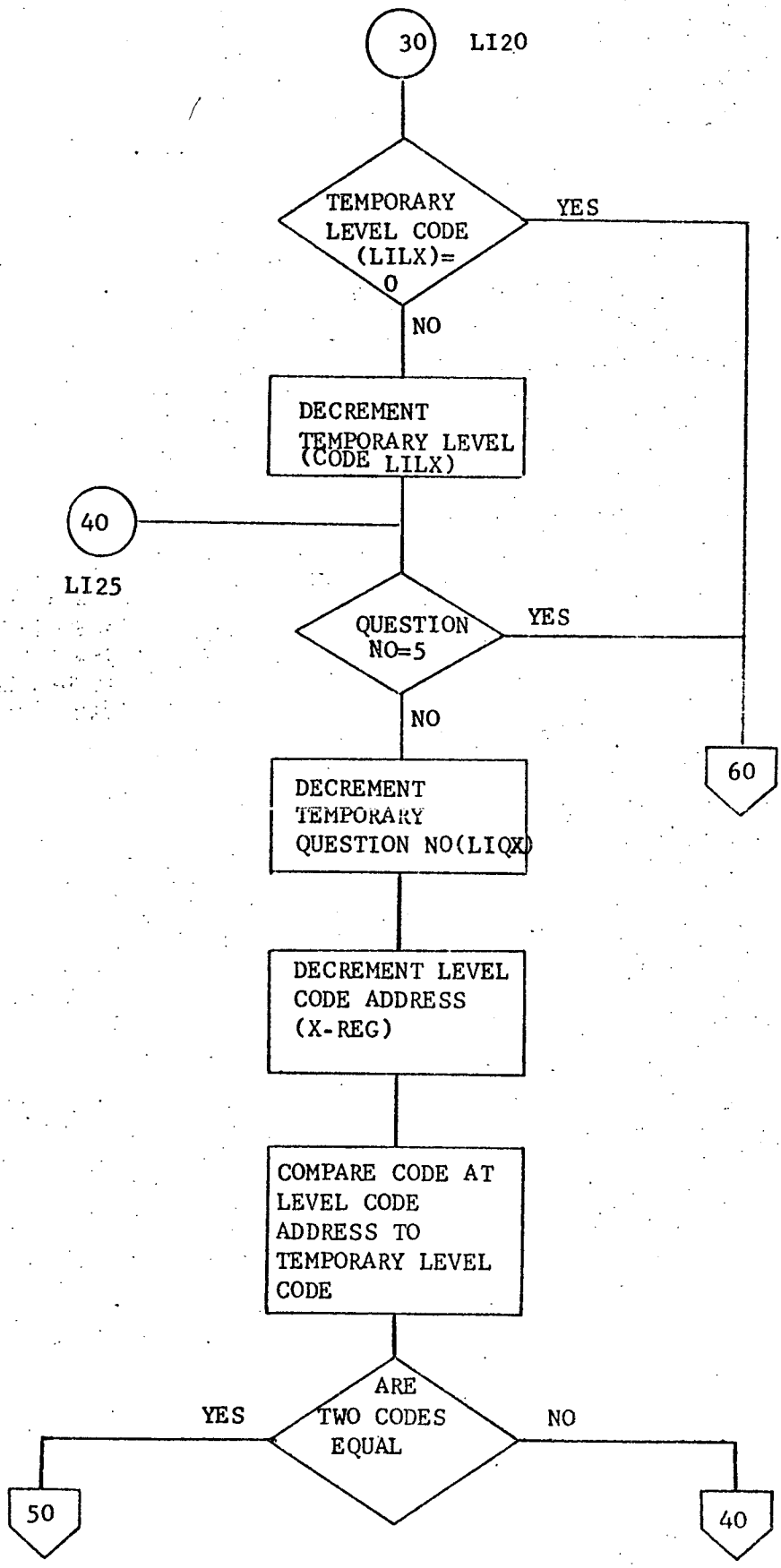
3.3.16.3.4 External References (Continued)

PK01	routine that packs characters two per word.
SE00	routine to output error message to system I/O device, the teletype.
TABF	buffer used to pack a line of data for output.
UP00	routine to unpack characters from buffer.

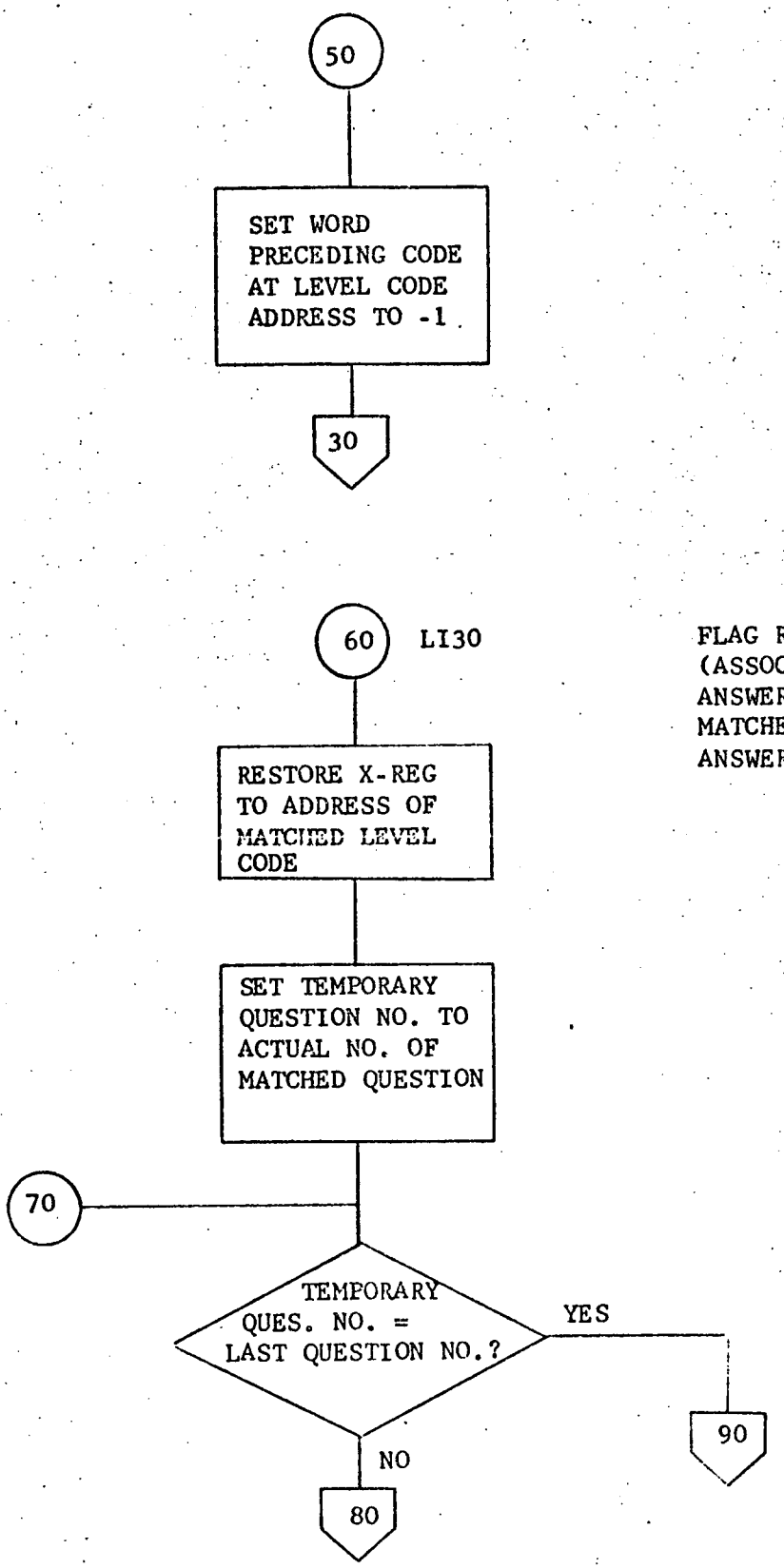
3.3.16.4 Detailed Flow Chart



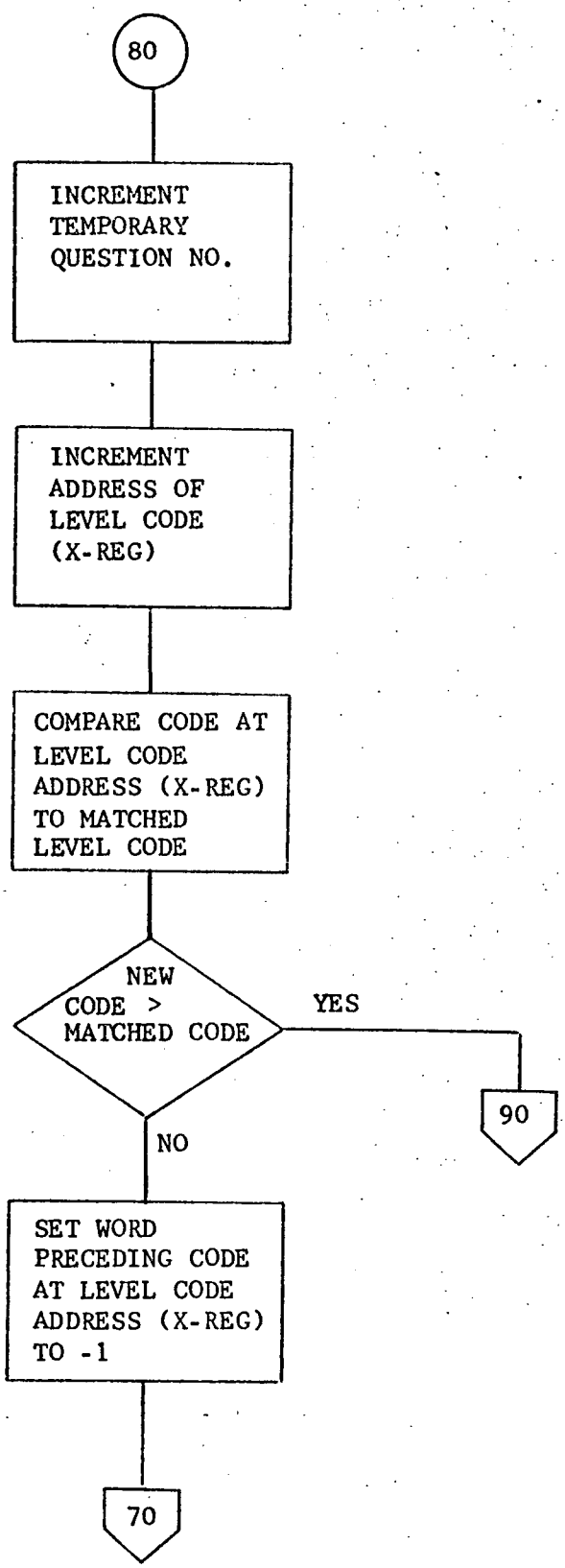

10
SET QUESTION NUMBER = 5 (LIQN)
20
LI10
MW00
MATCH WHAT
COMPARE A RECORD QUESTION TO ALL WHAT RESPONSE OPERANDS
MATCH
NO
YES
90
SET WORD PRE-CEDING LEVEL CODE OF MATCHED HEADING TO -1
SAVE MATCHED HEADING LEVEL CODE (LILC) (LILX)
30

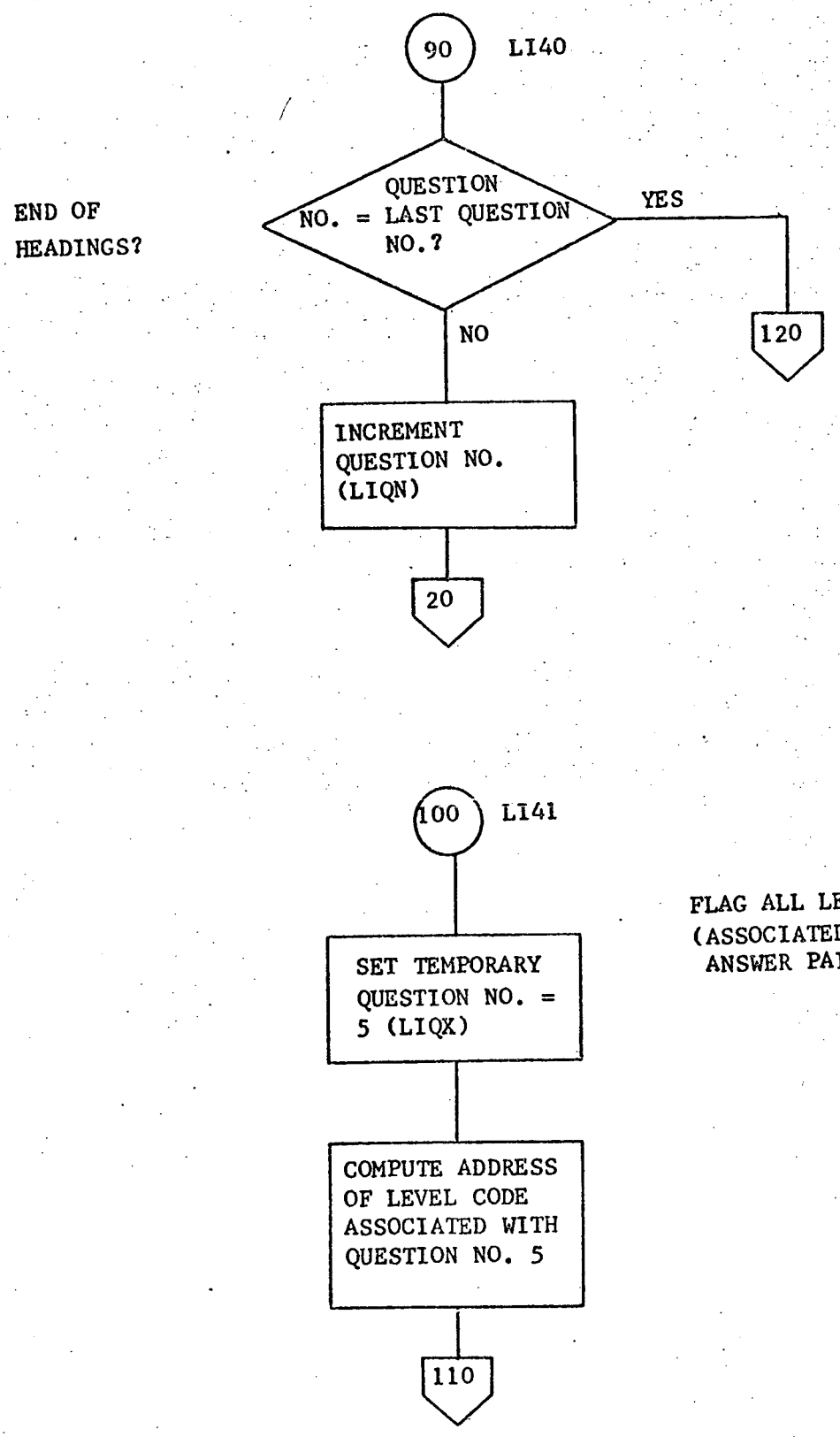


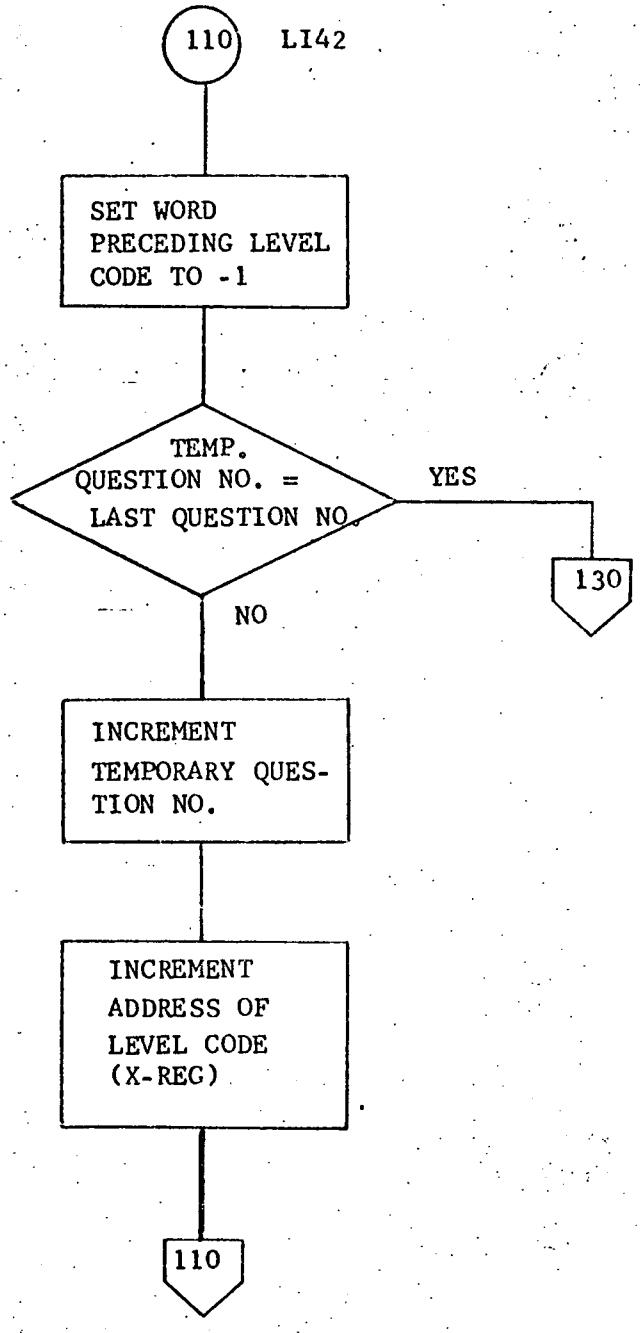
FLAG RELATED LEVEL CODES (ASSOCIATED WITH HEADING-ANSWER PAIRS) PRECEDING MATCHED LEVEL CODE (HEADING-ANSWER PAIR).

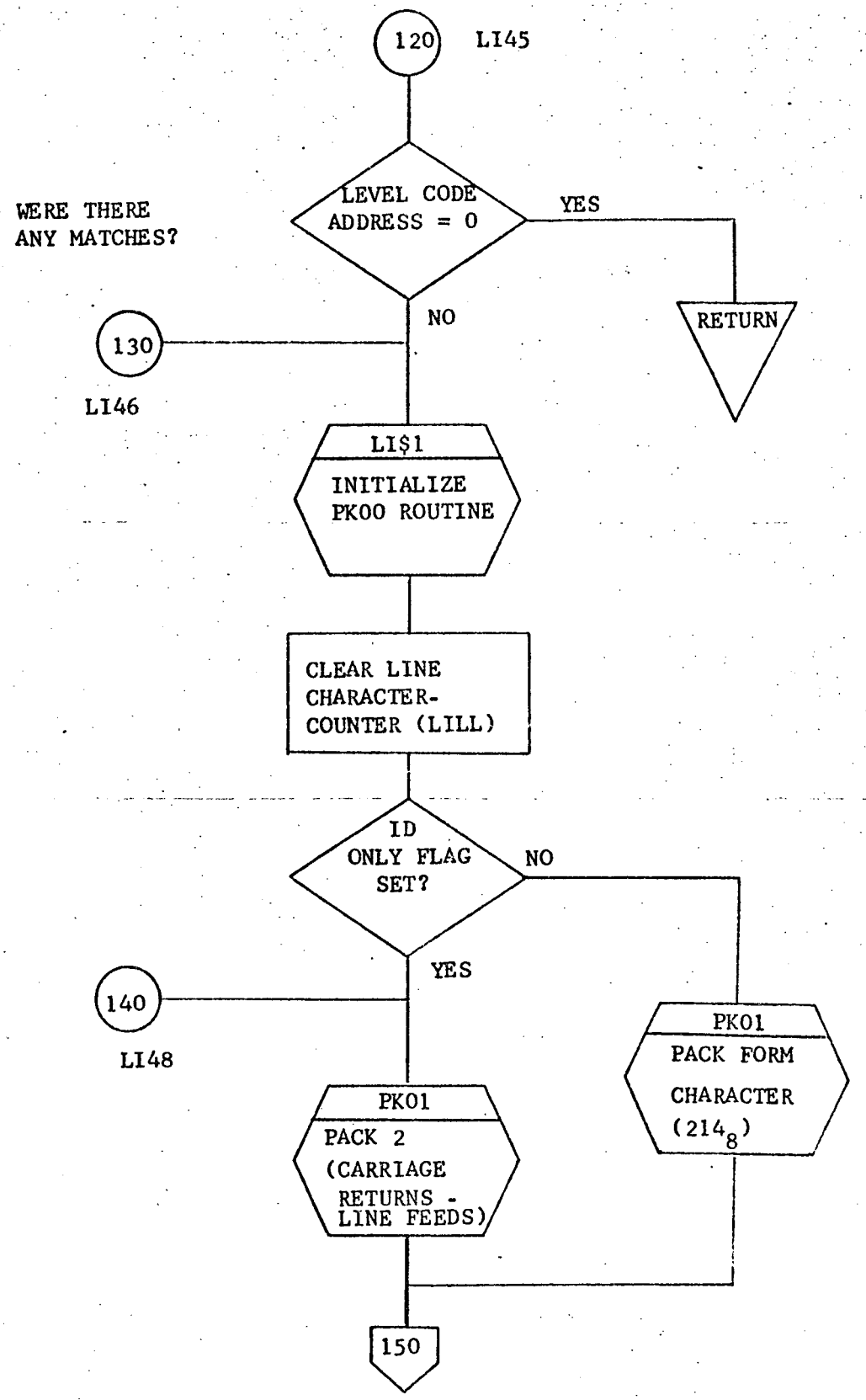


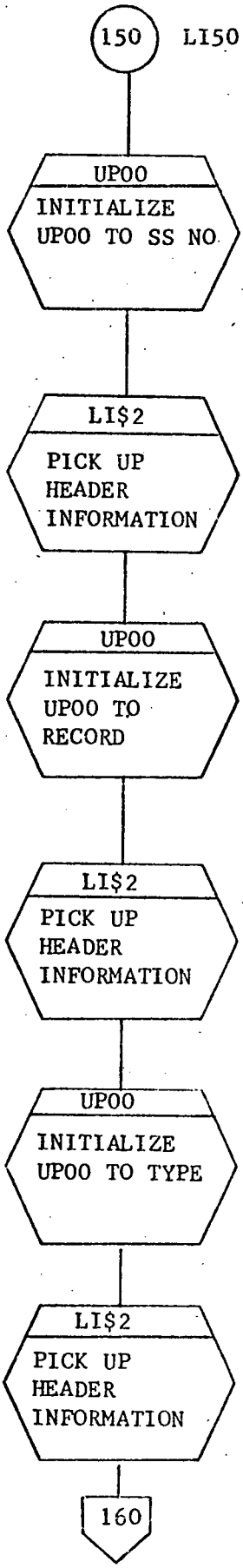
FLAG RELATED LEVEL CODES (ASSOCIATED WITH HEADING-ANSWER PAIRS) FOLLOWING MATCHED LEVEL CODE (HEADING-ANSWER PAIR)

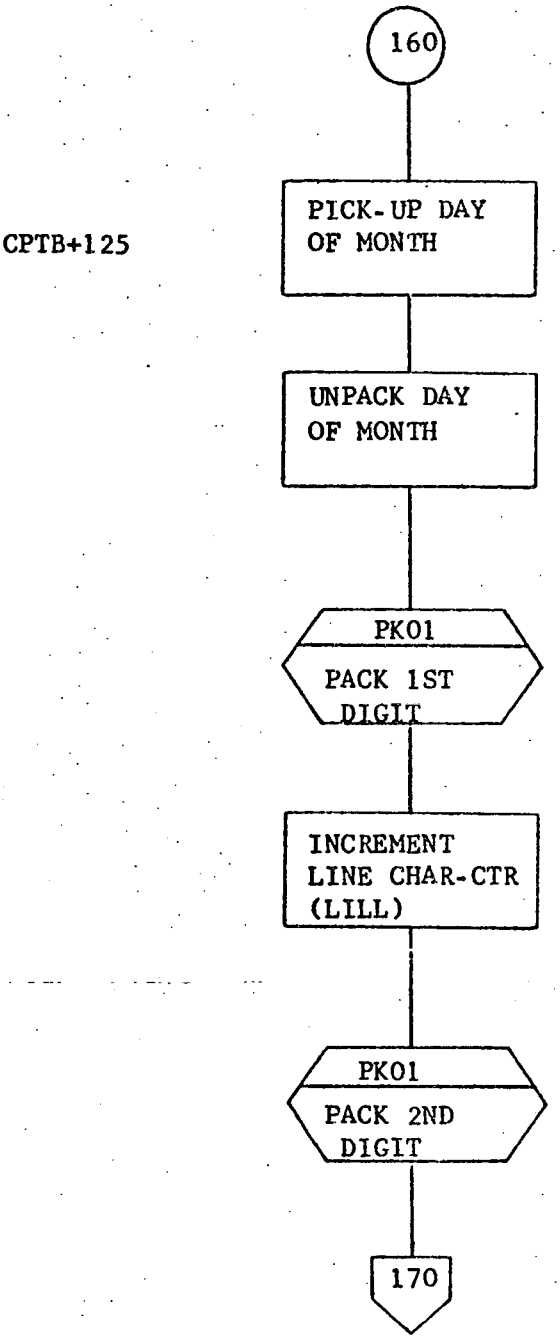

80
INCREMENT TEMPORARY QUESTION NO.
INCREMENT ADDRESS OF LEVEL CODE (X-REG)
COMPARE CODE AT LEVEL CODE ADDRESS (X-REG) TO MATCHED LEVEL CODE
NEW CODE > MATCHED CODE
YES
90
NO
SET WORD PRECEDING CODE AT LEVEL CODE ADDRESS (X-REG) TO -1
70

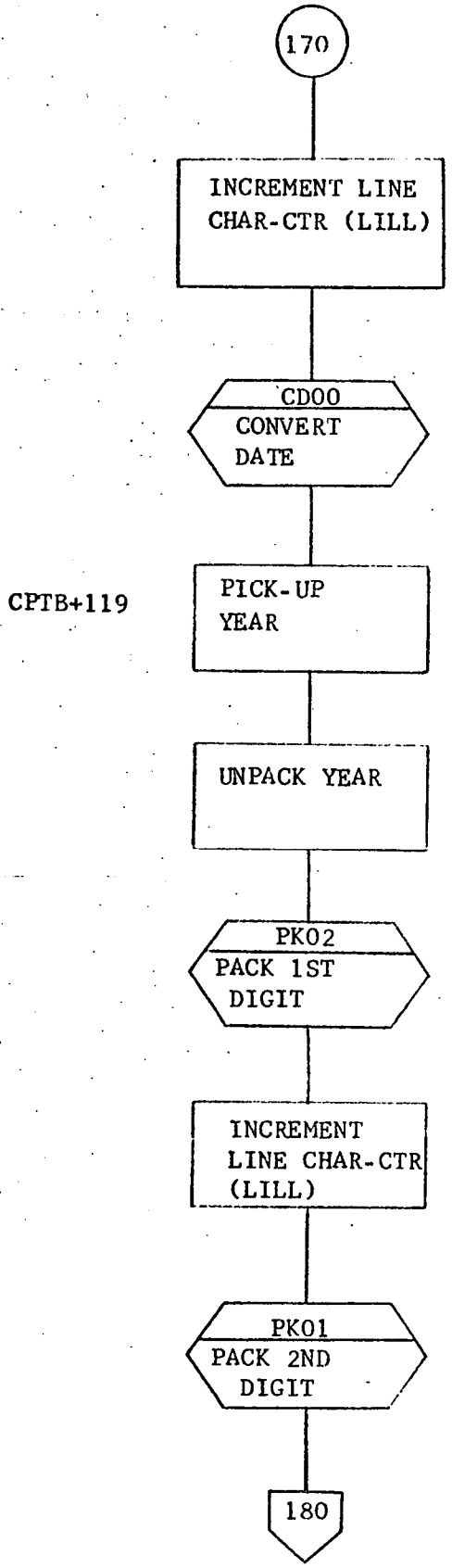

90
LI40
END OF HEADINGS?
QUESTION NO. = LAST QUESTION NO.?
YES
NO
120
INCREMENT QUESTION NO. (LIQN)
20
100
LI41
FLAG ALL LEVEL CODES (ASSOCIATED WITH HEADING-ANSWER PAIRS)
SET TEMPORARY QUESTION NO. = 5 (LIQX)
COMPUTE ADDRESS OF LEVEL CODE ASSOCIATED WITH QUESTION NO. 5
110

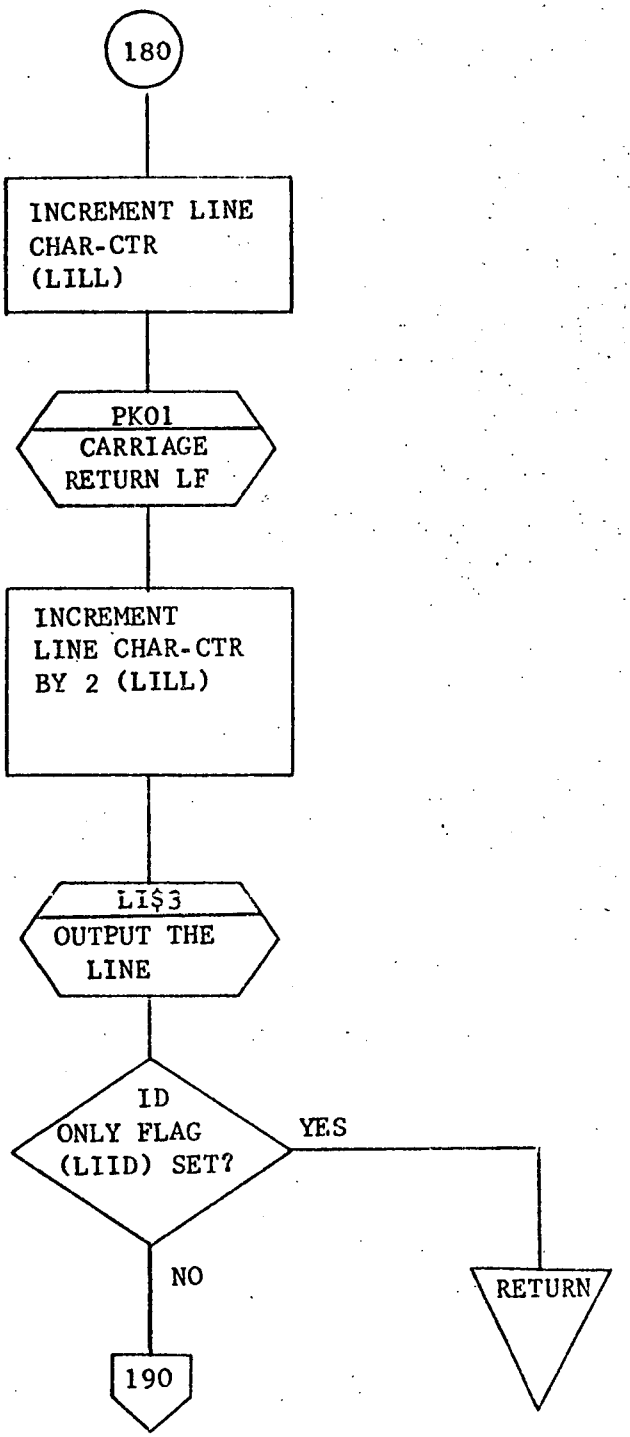

110
LI42
SET WORD PRECEDING LEVEL CODE TO -1
TEMP. QUESTION NO. = LAST QUESTION NO.
YES
130
NO
INCREMENT TEMPORARY QUESTION NO.
INCREMENT ADDRESS OF LEVEL CODE (X-REG)
110

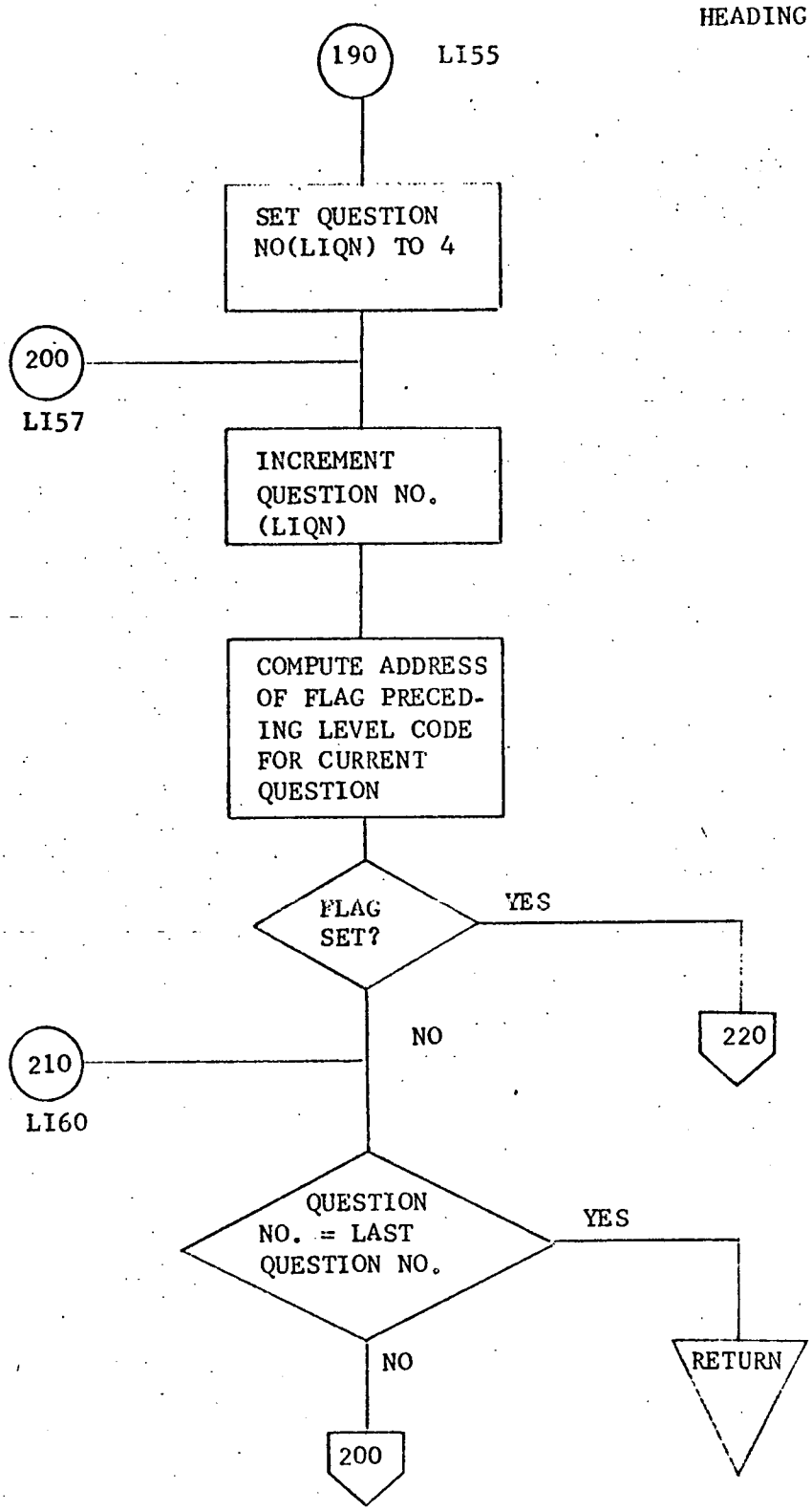

120
LI45
WERE THERE ANY MATCHES?
LEVEL CODE ADDRESS = 0
YES
NO
RETURN
130
LI46
LI$1
INITIALIZE PK00 ROUTINE
CLEAR LINE CHARACTER-COUNTER (LILL)
ID ONLY FLAG SET?
NO
YES
140
LI48
PK01
PACK FORM CHARACTER (214_8)
PK01
PACK 2 (CARRIAGE RETURNS - LINE FEEDS)
150

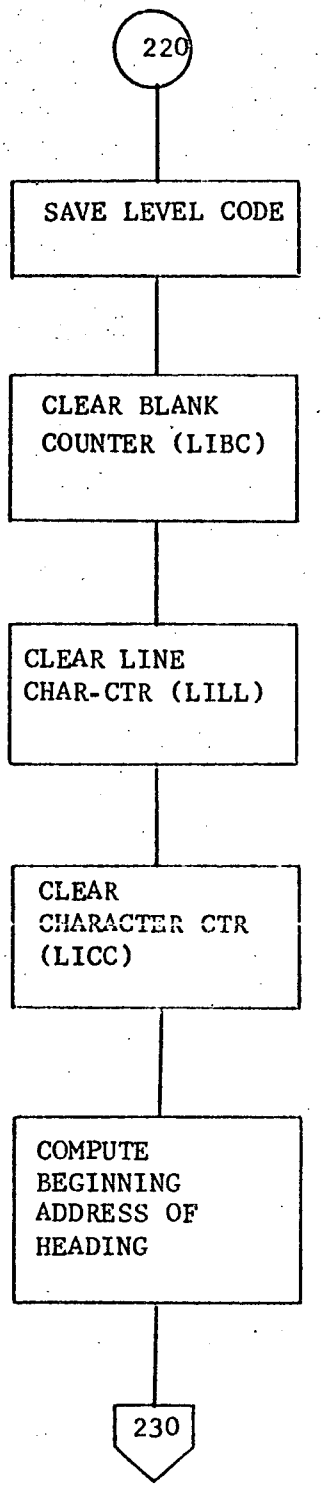

150
LI50
UP00
INITIALIZE
UP00 TO SS NO
LI$2
PICK UP
HEADER
INFORMATION
UP00
INITIALIZE
UP00 TO
RECORD
LI$2
PICK UP
HEADER
INFORMATION
UP00
INITIALIZE
UP00 TO TYPE
LI$2
PICK UP
HEADER
INFORMATION
160

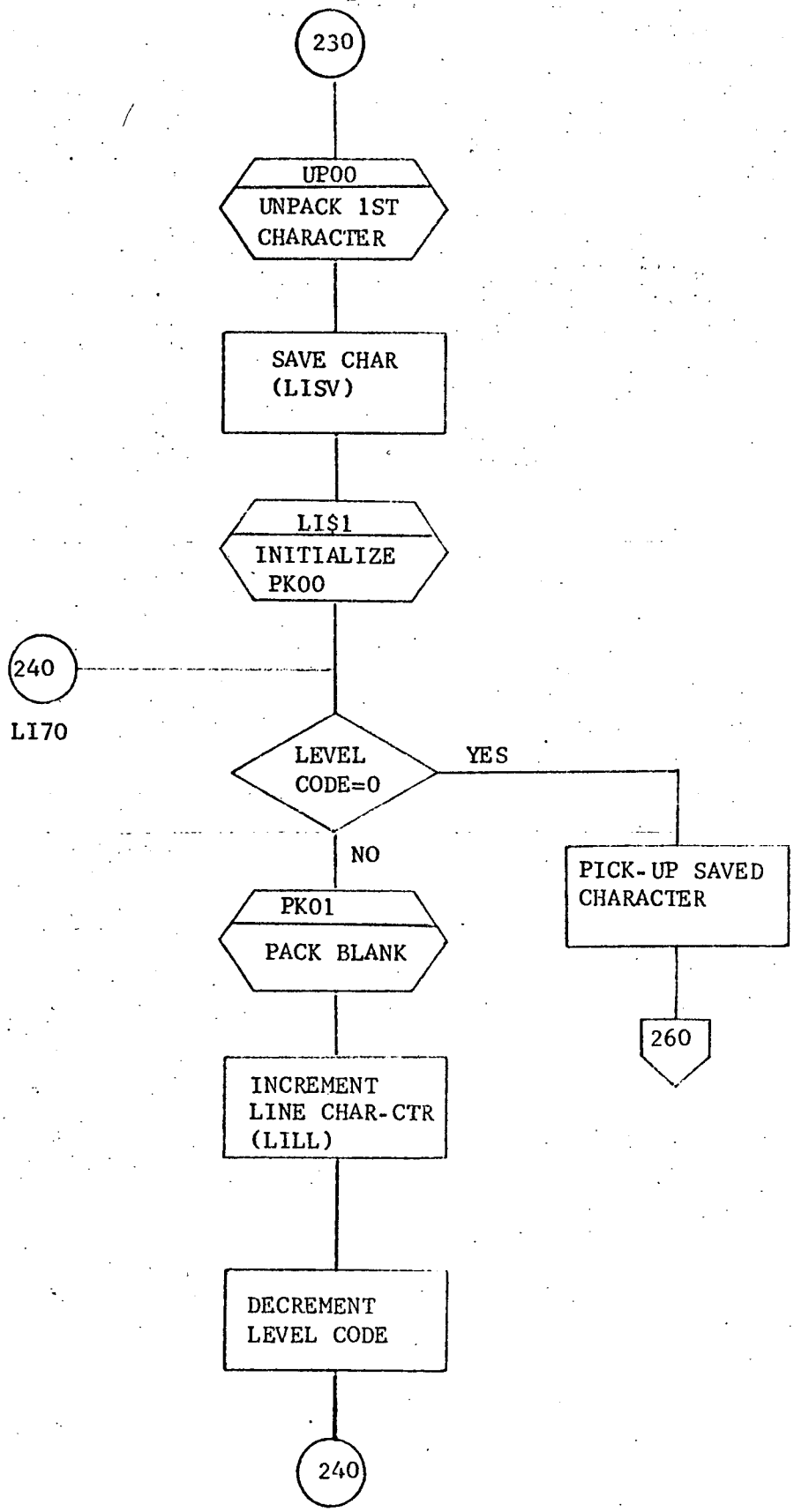

160
CPTB+125
PICK-UP DAY
OF MONTH
UNPACK DAY
OF MONTH
PK01
PACK 1ST
DIGIT
INCREMENT
LINE CHAR-CTR
(LILL)
PK01
PACK 2ND
DIGIT
170

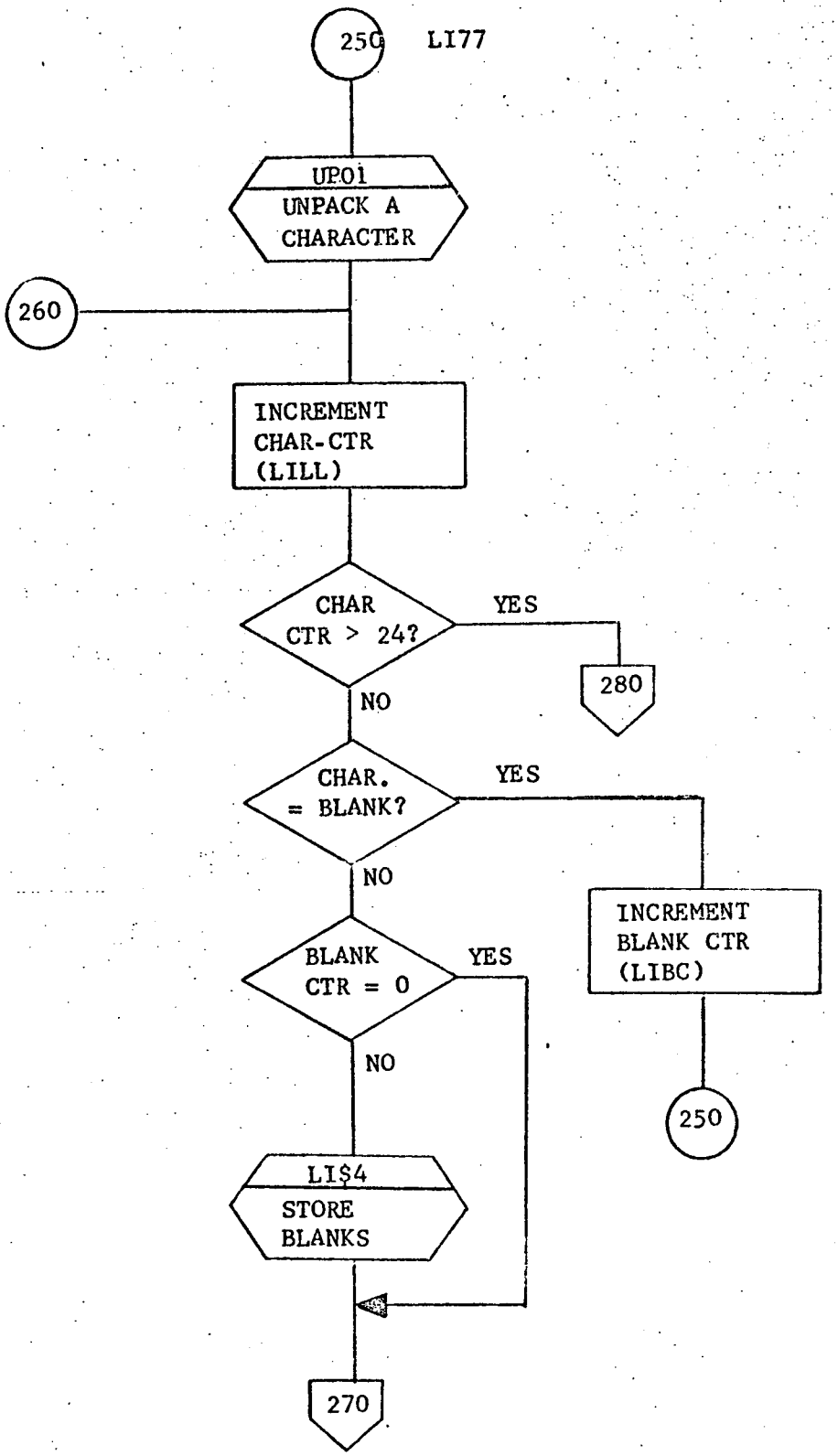

170
INCREMENT LINE CHAR-CTR (LILL)
CD00
CONVERT DATE
CPTB+119
PICK-UP YEAR
UNPACK YEAR
PK02
PACK 1ST DIGIT
INCREMENT LINE CHAR-CTR (LILL)
PK01
PACK 2ND DIGIT
180

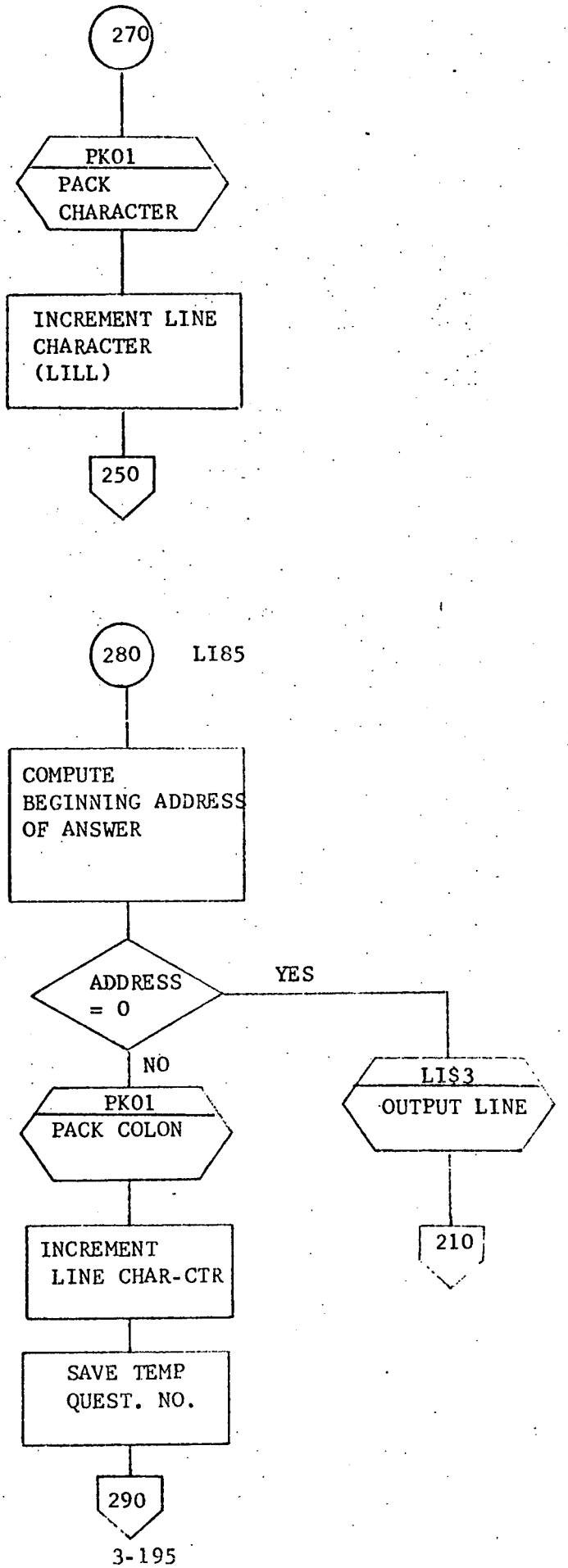

180
INCREMENT LINE CHAR-CTR (LILL)
PK01
CARRIAGE RETURN LF
INCREMENT LINE CHAR-CTR BY 2 (LILL)
LI$3
OUTPUT THE LINE
ID ONLY FLAG (LIID) SET?
YES
NO
RETURN
190

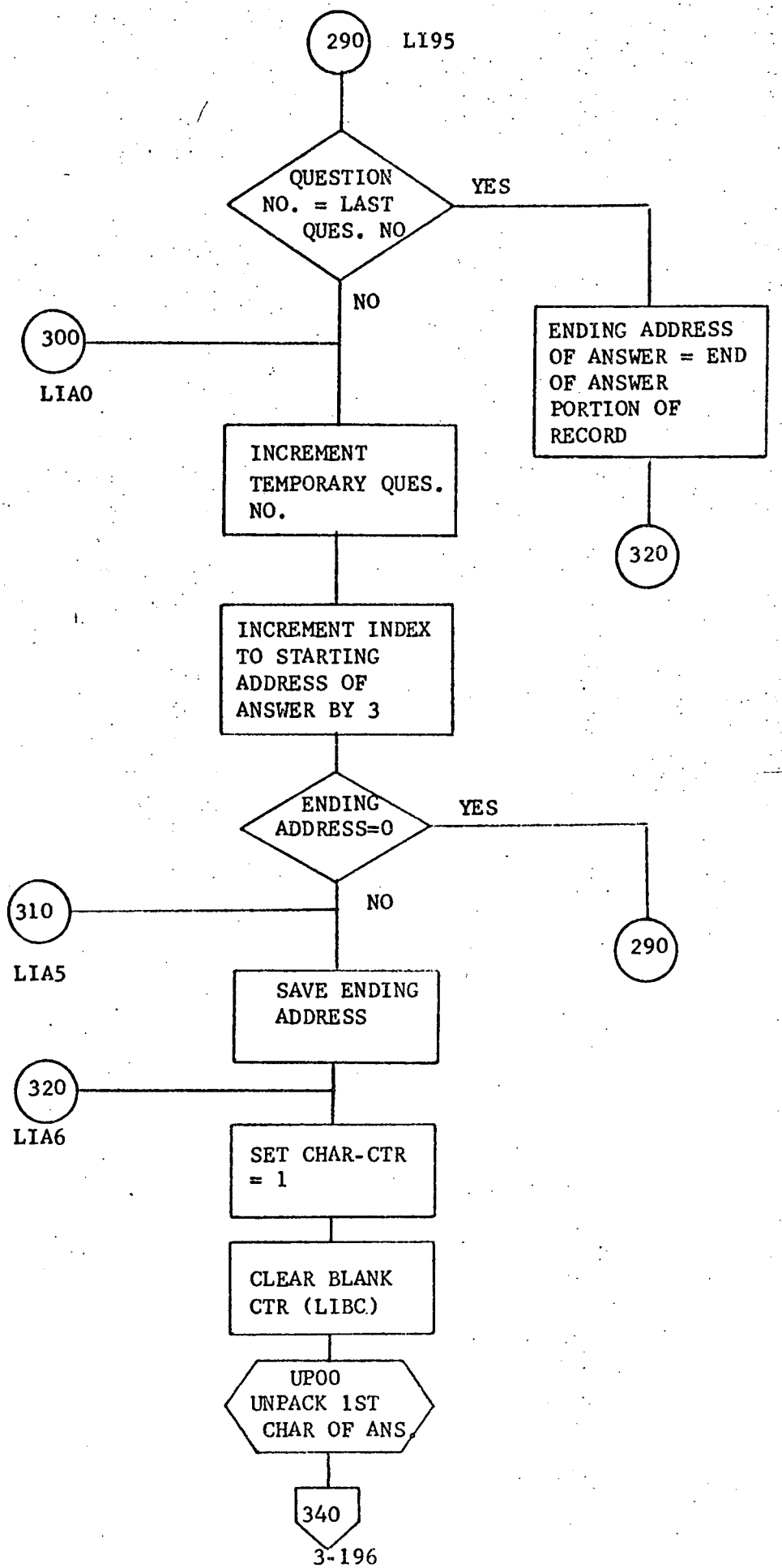

190
LI55
SET QUESTION NO(LIQN) TO 4
200
LI57
INCREMENT QUESTION NO. (LIQN)
COMPUTE ADDRESS OF FLAG PRECEDING LEVEL CODE FOR CURRENT QUESTION
FLAG SET?
YES
NO
220
210
LI60
QUESTION NO. = LAST QUESTION NO.
YES
NO
RETURN
200

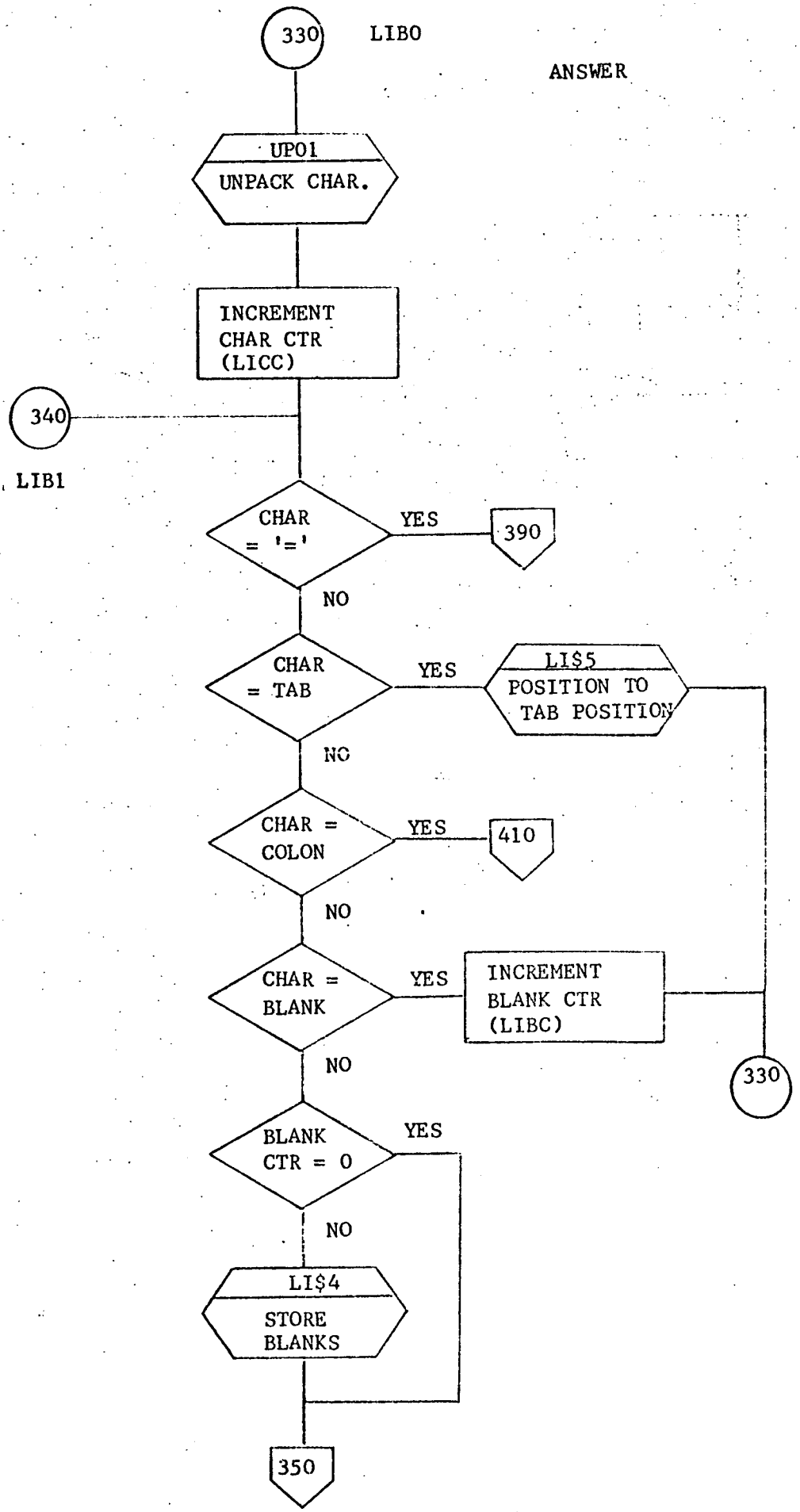

220
SAVE LEVEL CODE
CLEAR BLANK COUNTER (LIBC)
CLEAR LINE CHAR-CTR (LILL)
CLEAR CHARACTER CTR (LICC)
COMPUTE BEGINNING ADDRESS OF HEADING
230

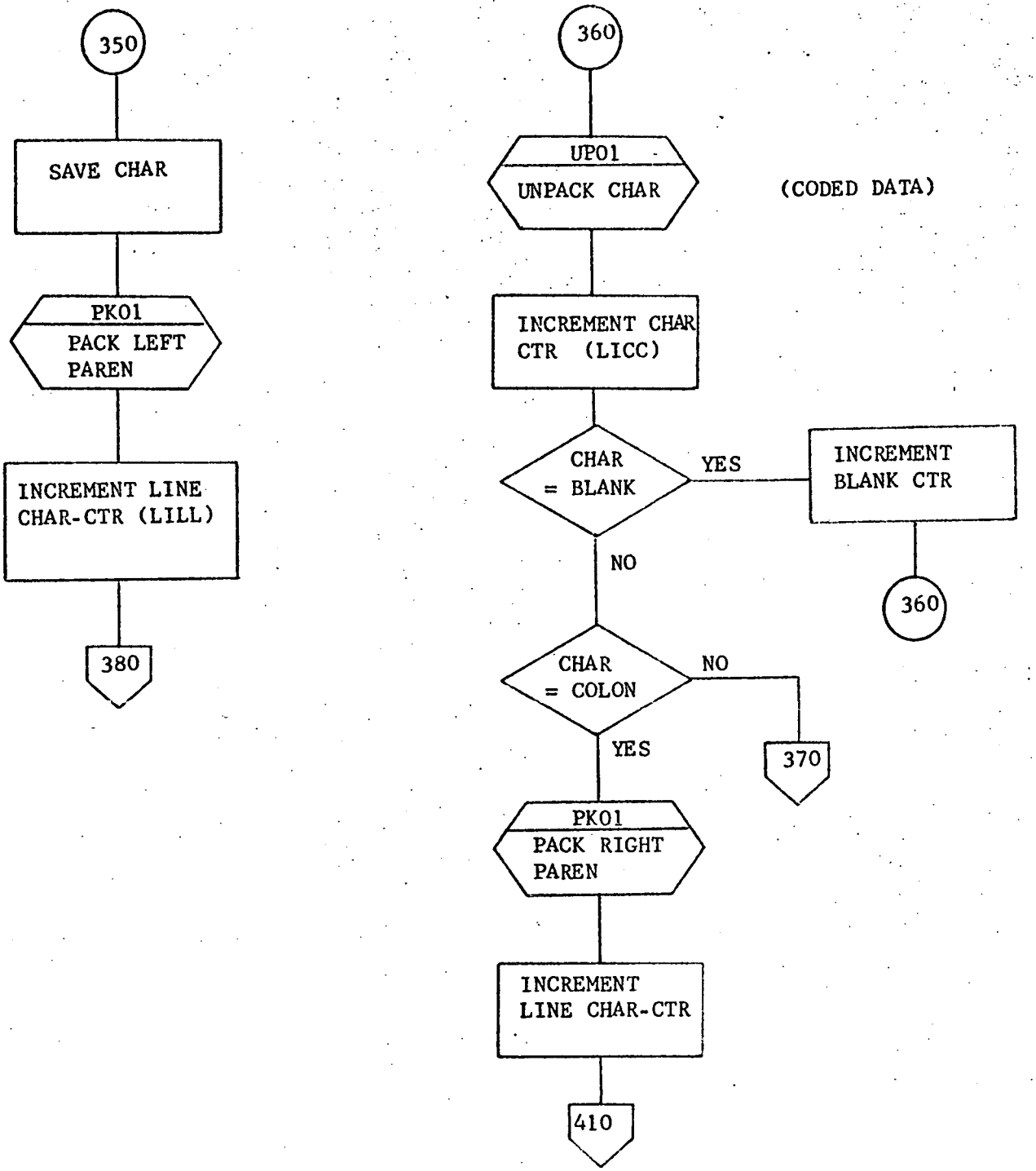

230
UP00
UNPACK 1ST CHARACTER
SAVE CHAR (LISV)
LI$1
INITIALIZE PK00
240
LI70
LEVEL CODE=0
YES
NO
PICK-UP SAVED CHARACTER
260
PK01
PACK BLANK
INCREMENT LINE CHAR-CTR (LILL)
DECREMENT LEVEL CODE
240

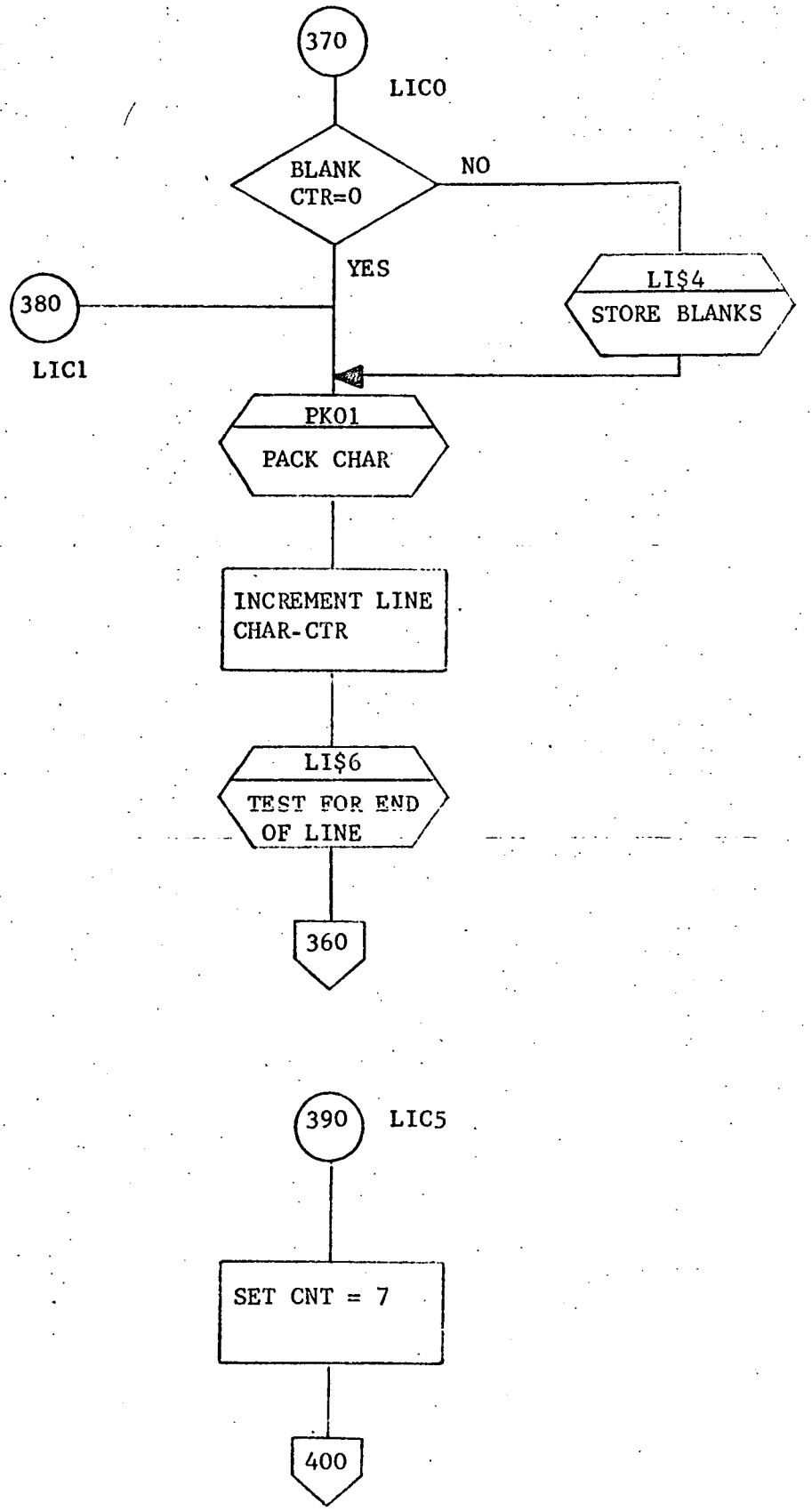

250
LI77
UP01
UNPACK A
CHARACTER
260
INCREMENT
CHAR-CTR
(LILL)
CHAR
CTR > 24?
YES
280
NO
CHAR.
= BLANK?
YES
NO
INCREMENT
BLANK CTR
(LIBC)
BLANK
CTR = 0
YES
NO
250
LI$4
STORE
BLANKS
270

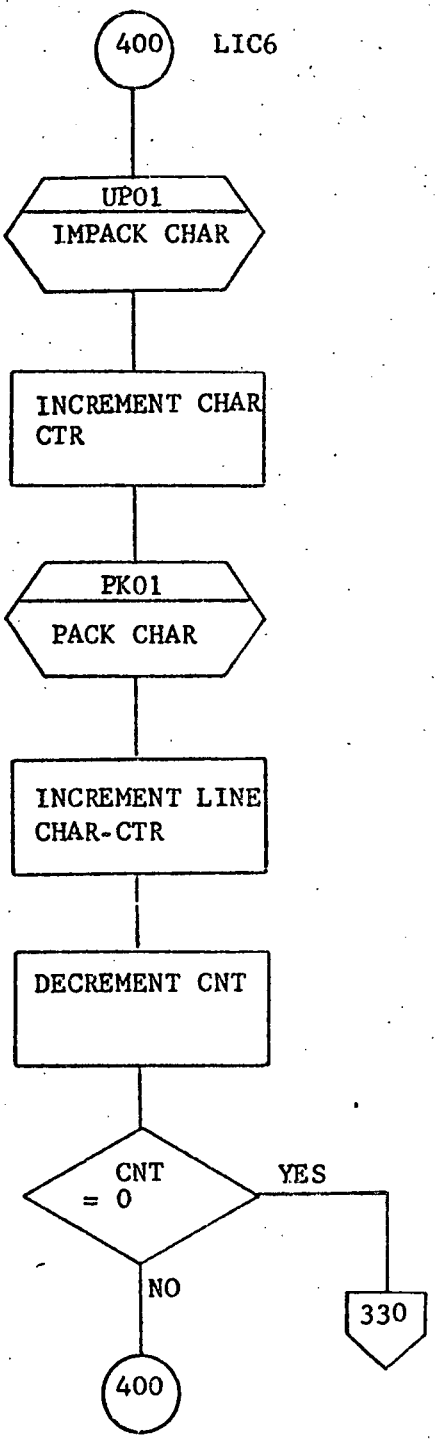

270
PK01
PACK
CHARACTER
INCREMENT LINE
CHARACTER
(LILL)
250
280
LI85
COMPUTE
BEGINNING ADDRESS
OF ANSWER
ADDRESS
= 0
YES
NO
PK01
PACK COLON
LI$3
OUTPUT LINE
INCREMENT
LINE CHAR-CTR
210
SAVE TEMP
QUEST. NO.
290

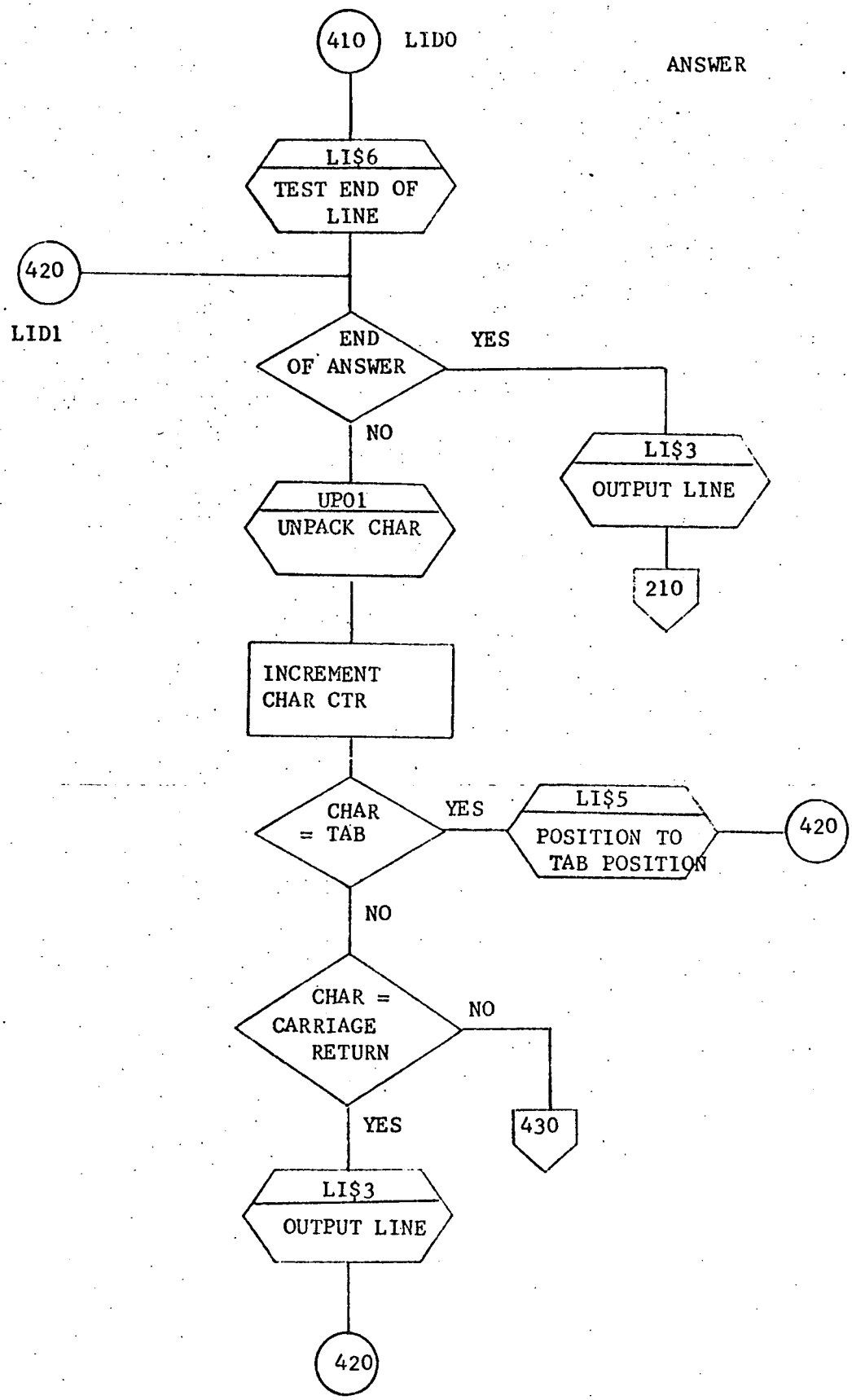

290
LI95
QUESTION NO. = LAST QUES. NO
YES
NO
300
LIA0
ENDING ADDRESS OF ANSWER = END OF ANSWER PORTION OF RECORD
320
INCREMENT TEMPORARY QUES. NO.
INCREMENT INDEX TO STARTING ADDRESS OF ANSWER BY 3
ENDING ADDRESS=0
YES
NO
310
LIA5
290
SAVE ENDING ADDRESS
320
LIA6
SET CHAR-CTR = 1
CLEAR BLANK CTR (LIBC)
UP00 UNPACK 1ST CHAR OF ANS
340


330
LIBO
ANSWER
UP01
UNPACK CHAR.
INCREMENT CHAR CTR (LICC)
340
LIB1
CHAR = '='
YES
390
NO
CHAR = TAB
YES
LI$5
POSITION TO TAB POSITION
NO
CHAR = COLON
YES
410
NO
CHAR = BLANK
YES
INCREMENT BLANK CTR (LIBC)
330
NO
BLANK CTR = 0
YES
NO
LI$4
STORE BLANKS
350

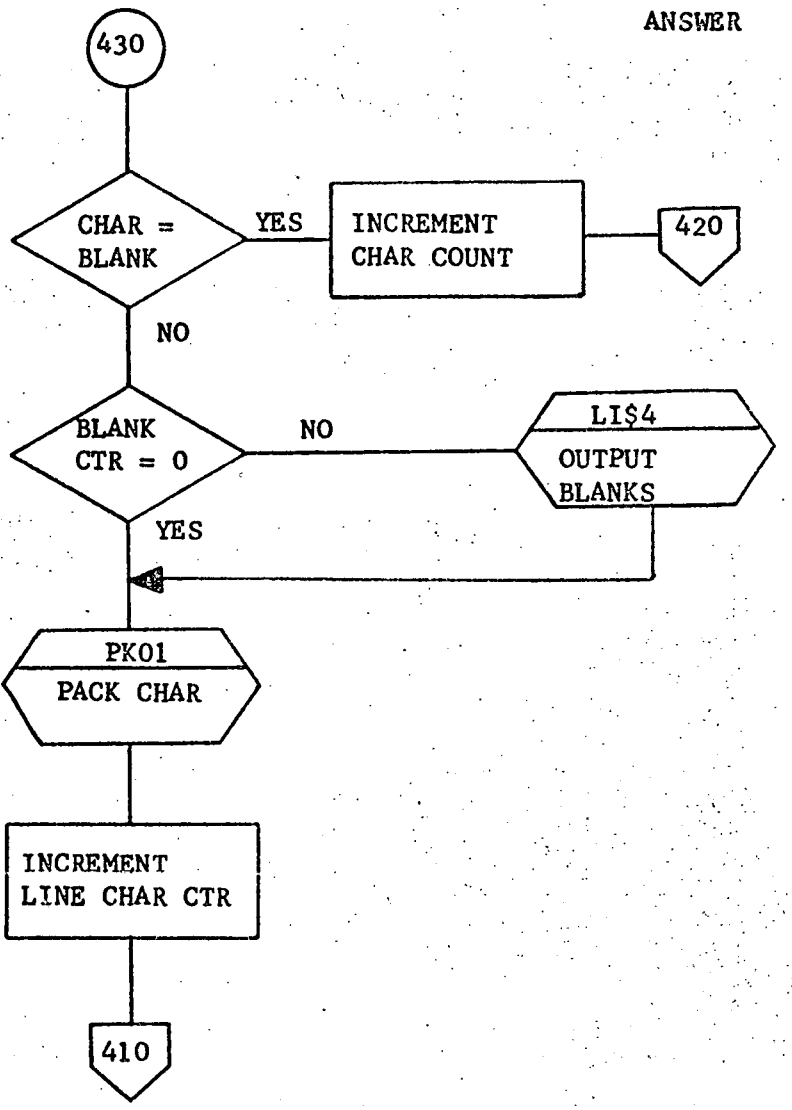

350
SAVE CHAR
PK01
PACK LEFT PAREN
INCREMENT LINE CHAR-CTR (LILL)
380
360
UP01
UNPACK CHAR
(CODED DATA)
INCREMENT CHAR CTR (LICC)
CHAR = BLANK
YES
INCREMENT BLANK CTR
360
NO
CHAR = COLON
NO
370
YES
PK01
PACK RIGHT PAREN
INCREMENT LINE CHAR-CTR
410

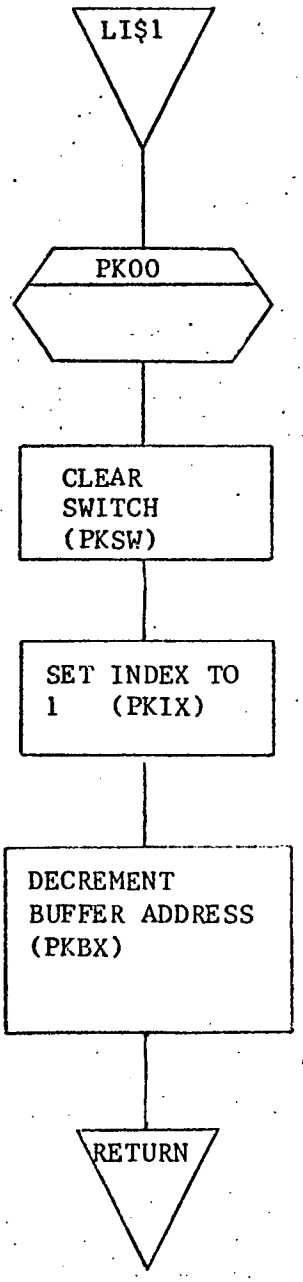

370
LIC0
BLANK CTR=0
NO
YES
LI$4
STORE BLANKS
380
LIC1
PK01
PACK CHAR
INCREMENT LINE CHAR-CTR
LI$6
TEST FOR END OF LINE
360
390
LIC5
SET CNT = 7
400


400
LIC6
UP01
IMPACK CHAR
INCREMENT CHAR CTR
PK01
PACK CHAR
INCREMENT LINE CHAR-CTR
DECREMENT CNT
CNT = 0
YES
NO
330
400

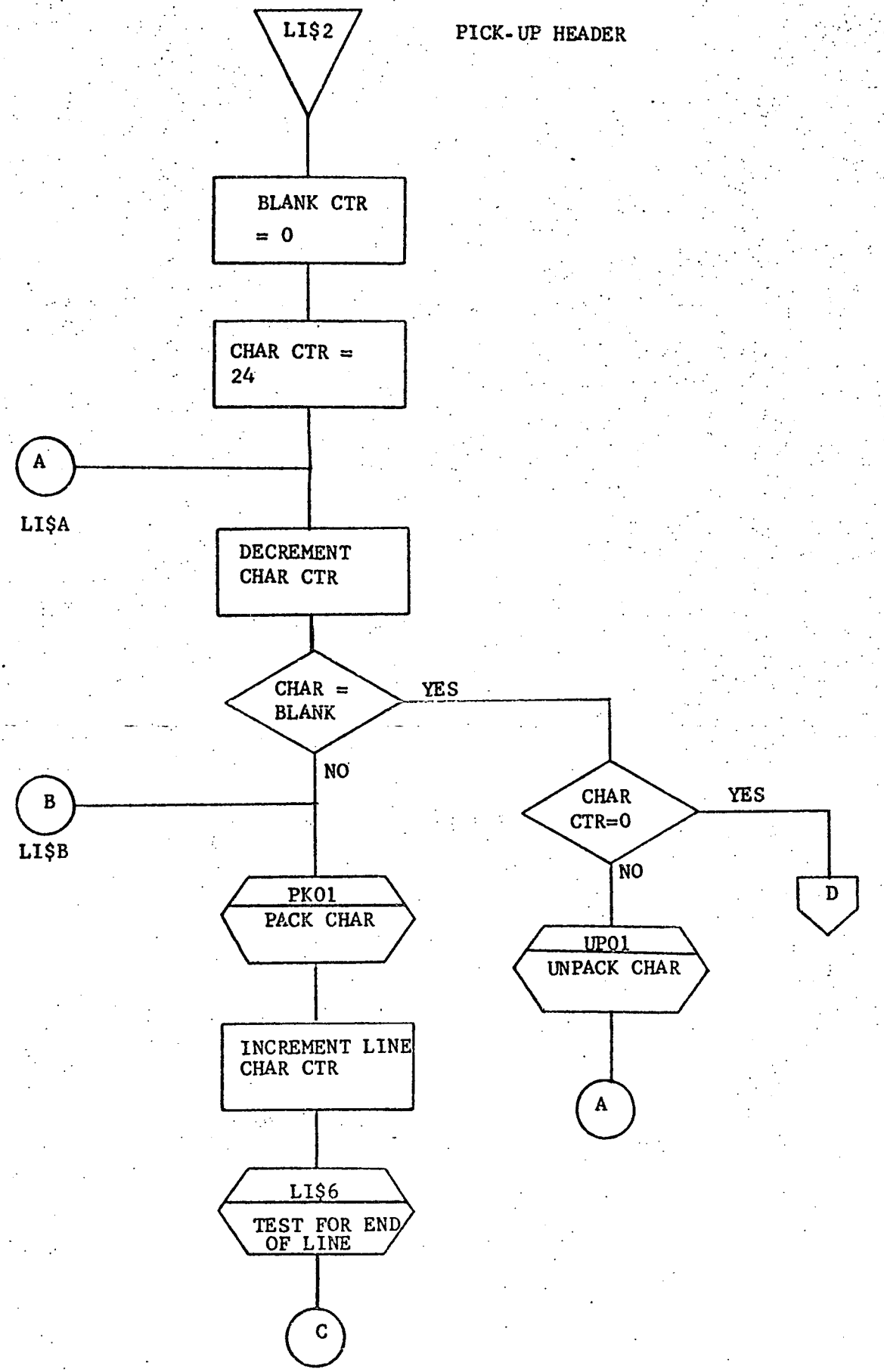

410
LIDO
ANSWER
LI$6
TEST END OF LINE
420
LID1
END OF ANSWER
YES
NO
LI$3
OUTPUT LINE
210
UP01
UNPACK CHAR
INCREMENT CHAR CTR
CHAR = TAB
YES
LI$5
POSITION TO TAB POSITION
420
NO
CHAR = CARRIAGE RETURN
NO
430
YES
LI$3
OUTPUT LINE
420

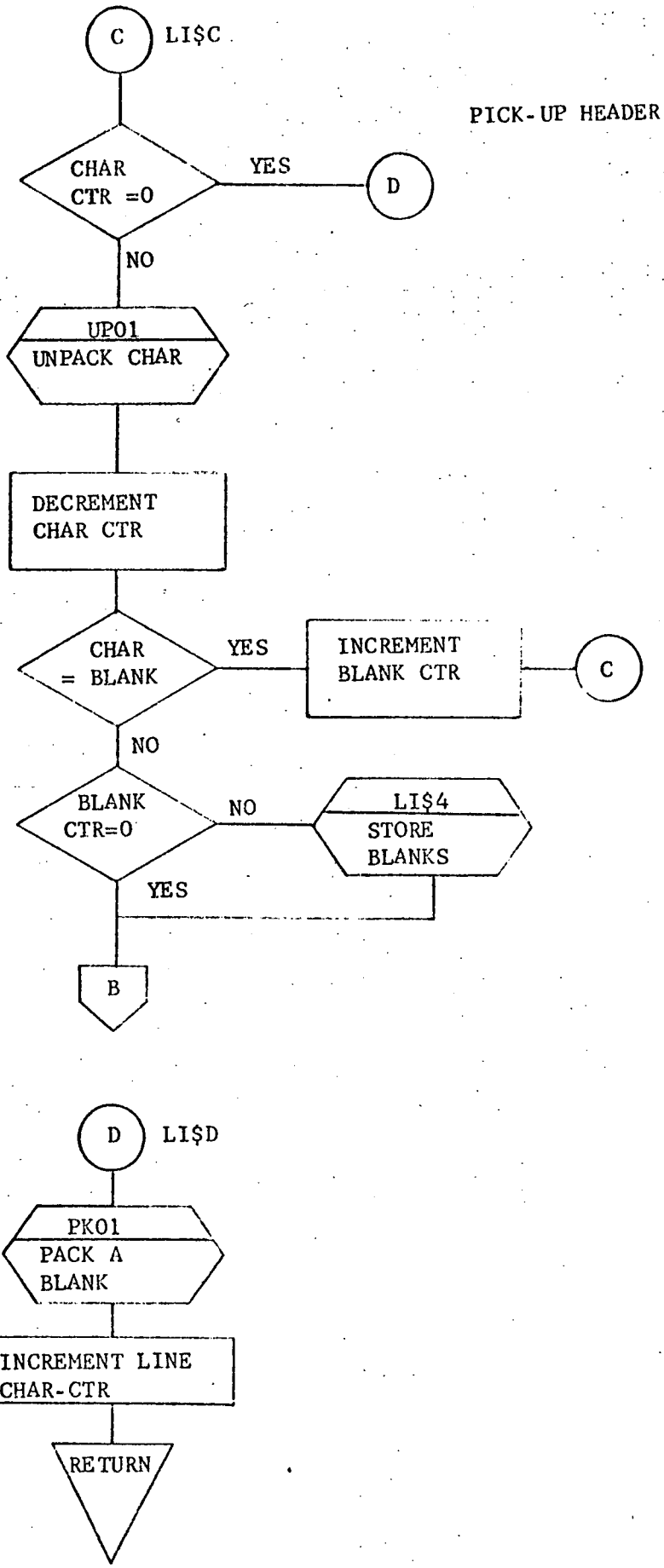
ANSWER

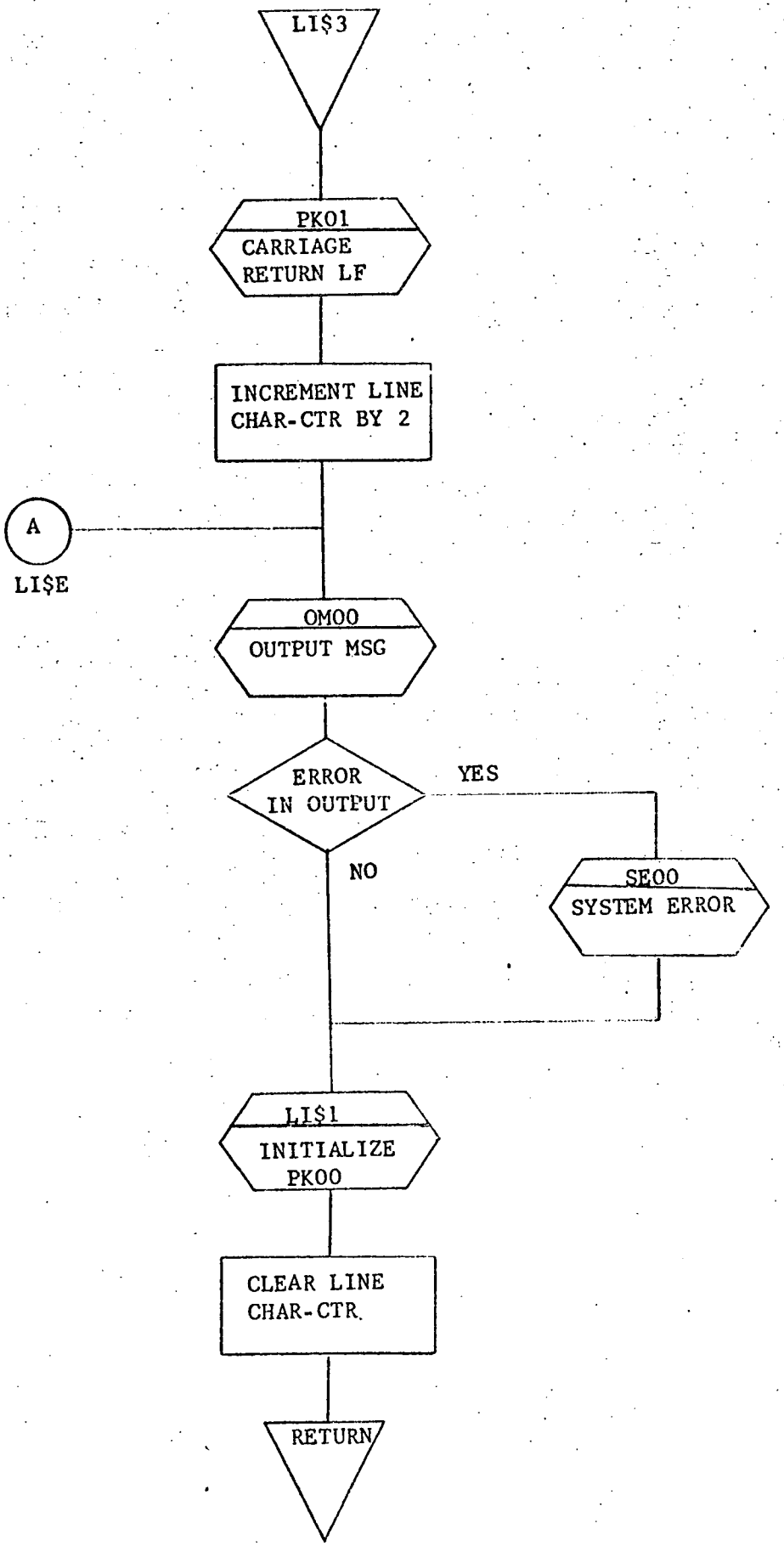

430
CHAR = BLANK
YES
INCREMENT CHAR COUNT
420
NO
BLANK CTR = 0
NO
LI$4
OUTPUT BLANKS
YES
PK01
PACK CHAR
INCREMENT LINE CHAR CTR
410



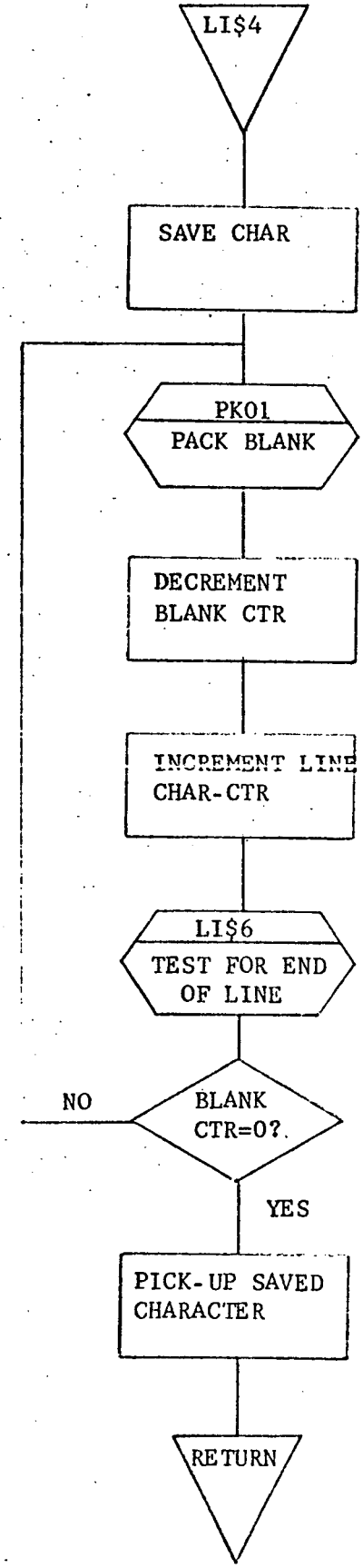
INITIALIZE PACK ROUTINE BUT
DO NOT CHARACTER


LI$2
PICK-UP HEADER
BLANK CTR
= 0
CHAR CTR =
24
A
LI$A
DECREMENT
CHAR CTR
CHAR =
BLANK
YES
NO
B
LI$B
CHAR
CTR=0
YES
NO
D
PK01
PACK CHAR
UP01
UNPACK CHAR
INCREMENT LINE
CHAR CTR
A
LI$6
TEST FOR END
OF LINE
C

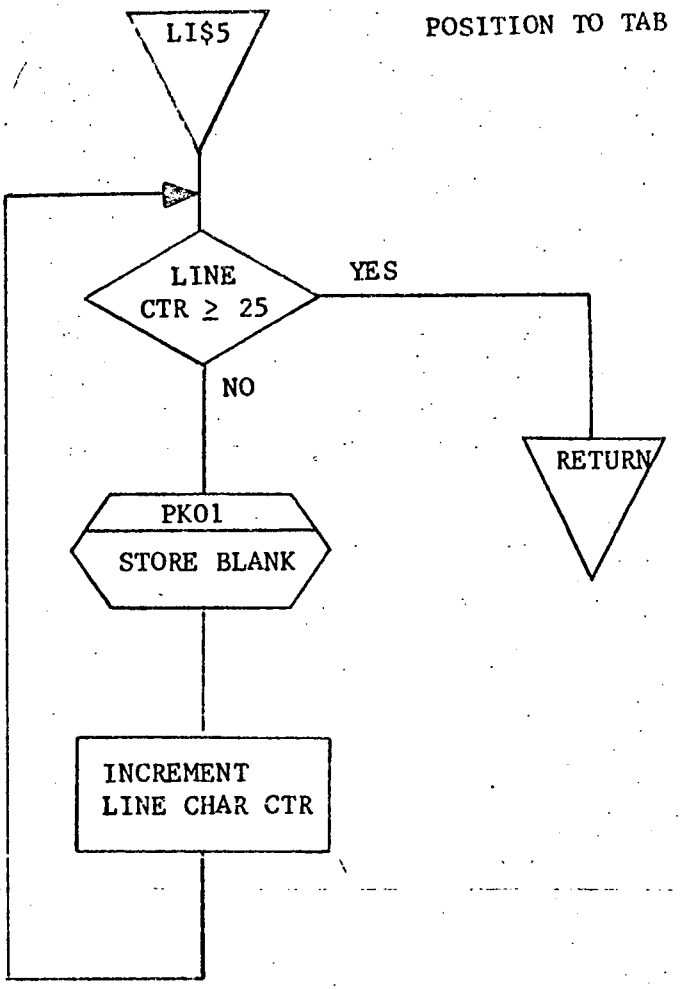

C
LI$C
PICK-UP HEADER
CHAR
CTR =0
YES
D
NO
UP01
UNPACK CHAR
DECREMENT
CHAR CTR
CHAR
= BLANK
YES
INCREMENT
BLANK CTR
C
NO
BLANK
CTR=0
NO
LI$4
STORE
BLANKS
YES
B
D
LI$D
PK01
PACK A
BLANK
INCREMENT LINE
CHAR-CTR
RETURN

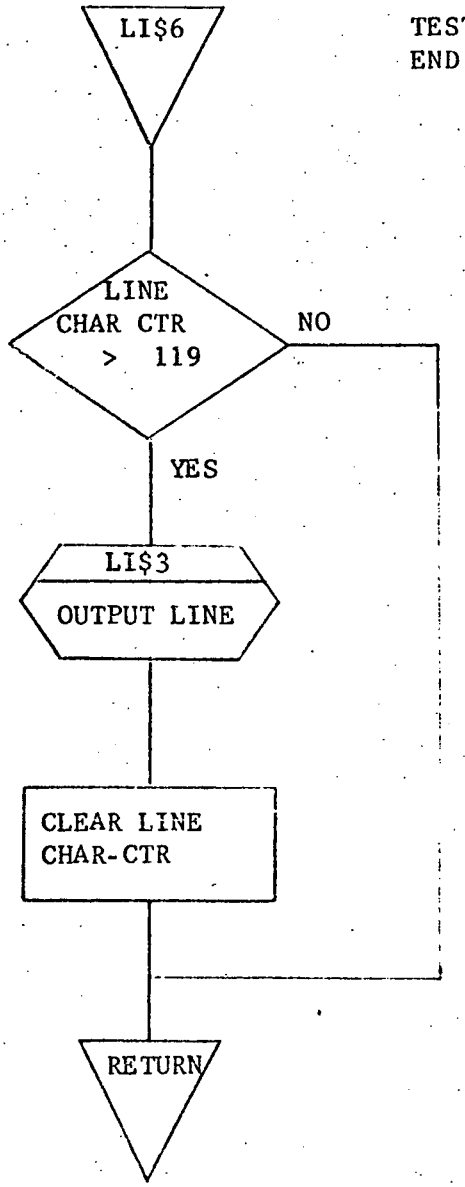

LI$3
PK01
CARRIAGE
RETURN LF
INCREMENT LINE
CHAR-CTR BY 2
A
LI$E
OM00
OUTPUT MSG
ERROR
IN OUTPUT
YES
NO
SE00
SYSTEM ERROR
LI$1
INITIALIZE
PK00
CLEAR LINE
CHAR-CTR.
RETURN

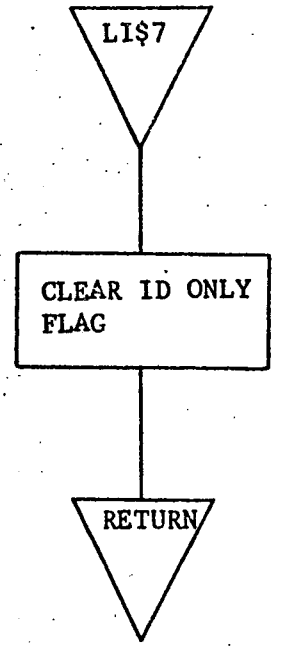
STORE BLANKS AS INDICATED BY BLANK CTR



POSITION TO TAB POSITION (25)




LI$6
TEST FOR
END OF LINE
LINE
CHAR CTR
> 119
NO
YES
LI$3
OUTPUT LINE
CLEAR LINE
CHAR-CTR
RETURN



WRAP UP LIST OPTION

3.3.17 MA00 - Match

3.3.17.1 Purpose

The purpose of the MATCH Subroutine (MA00) is to find a match in the Request Buffer and in the Tape Buffer.

3.3.17.2 Technical Description

MA00 compares the Tape Buffer to the Request Buffer. There are four types of matches that can be requested by the user: Heading Only, Headings and Prose Data, Headings and Numeric Values, and Headings and Range of Numeric Data.

MA00 checks for a match by heading in the Request Buffer and the Tape Buffer. If a request header matches, it makes a further test to ascertain whether the request is heading only, heading-prose, heading numeric value, or heading range of numeric value. If heading only has been requested, the 'match' exit is taken.

On heading-prose data the subroutine checks the answer of the Tape Buffer against the string of alphanumeric characters in the Request Buffer.

For heading-numeric value request, the numeric value in the Tape Buffer is converted to a pseudo floating point number. The value in the Request Buffer is also converted to the same pseudo floating point format. Then the pseudo floating point numbers are compared on the sign, the number of characters in pseudo floating point number, the number of characters to the left of the

decimal point, and the numeric values.

On a heading range request, MA00 converts the Tape Buffer value to the pseudo floating point format. The high and the low in the Request Buffer are converted to the pseudo floating point format and a range test made.

MAB0 is the second entry point into MA00 subroutine. The purpose for the second entry point is to convert numeric value in the Tape Buffer to pseudo floating point number format. MAB0 is called after MA00 is called to specify match of heading only.

3.3.17.2.1 Calling Sequence

CALL MA00, HEAD, OP, FLAG, SW

PARAMETER	FUNCTION
HEAD	The heading number to be checked in the Tape Buffer.
OP	Pointer to Operand Buffer.
FLAG	FLAG 0. Check only Heading: 1. Check Heading and Prose. 2. Check Heading and Numerical Data. 3. Check Heading and Range of Numerical Data. The words following the flag are pointers to 'Condition' or 'What' buffer when FLAG equals 1, 2 or 3.
SW	Switch to indicate whether Tape Buffer has been moved. MA00 set to -1 when moving the Tape Buffer, the user must set to zero when the new Heading number is checked.

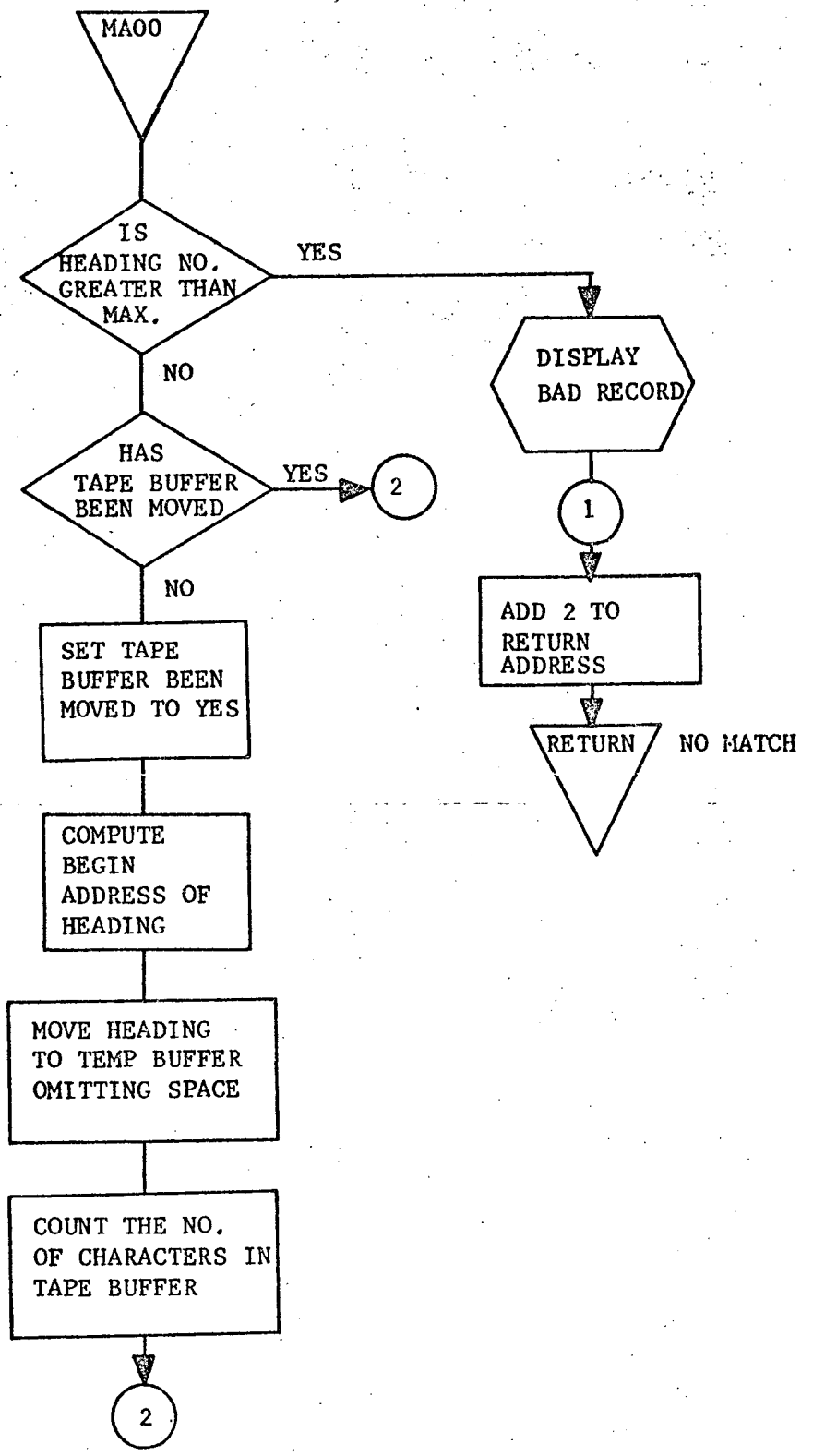
CALL MAB0

PARAMETER

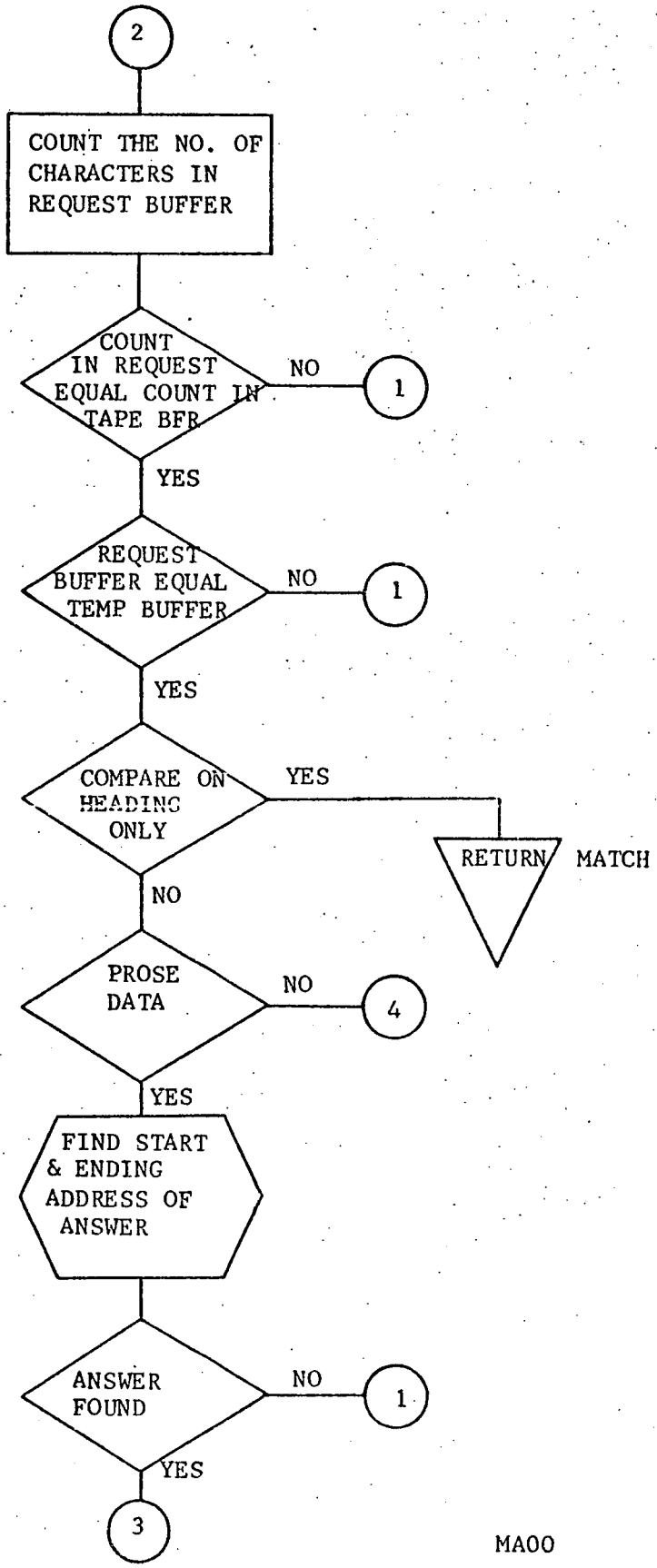
A call to MA00 must have been made to set up parameters for MAB0

REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	N/A	Modified
B	N/A	Modified
X	N/A	Modified
Overflow	N/A	N/A

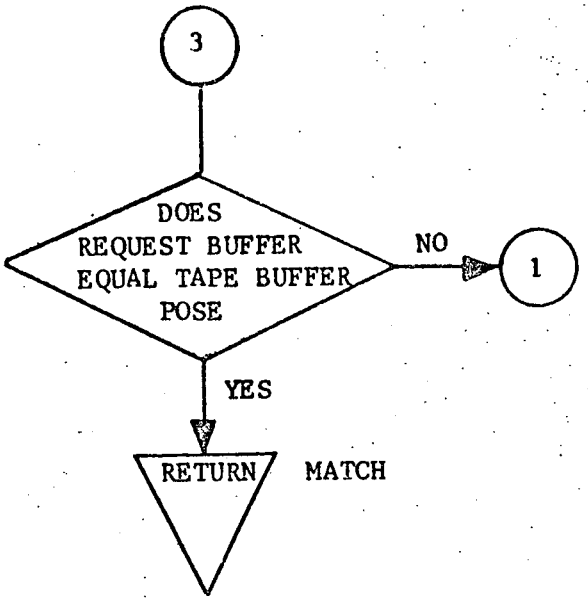
3.3.17.2.2 General Flow Chart

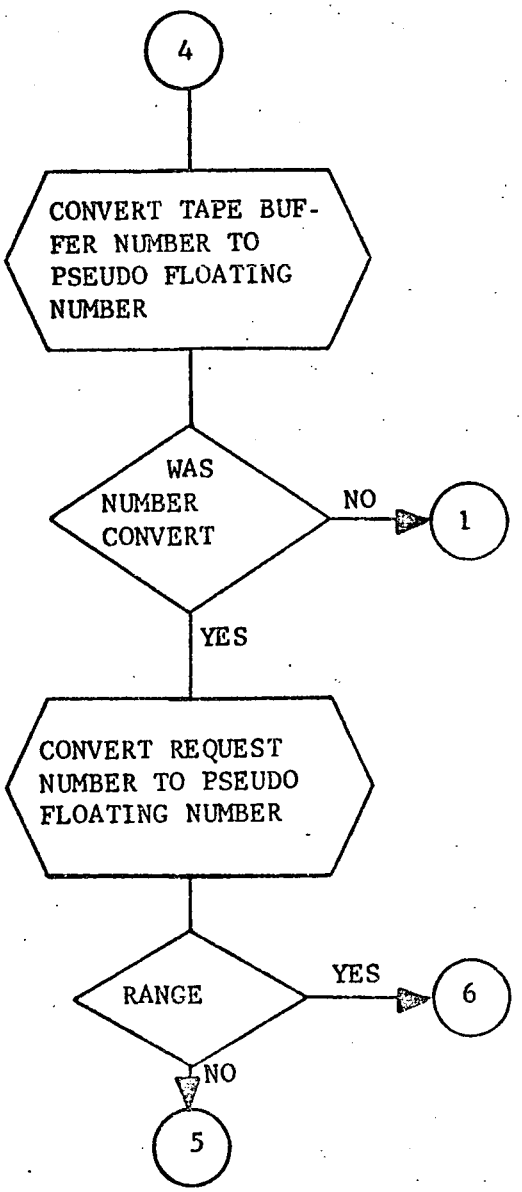


MA00

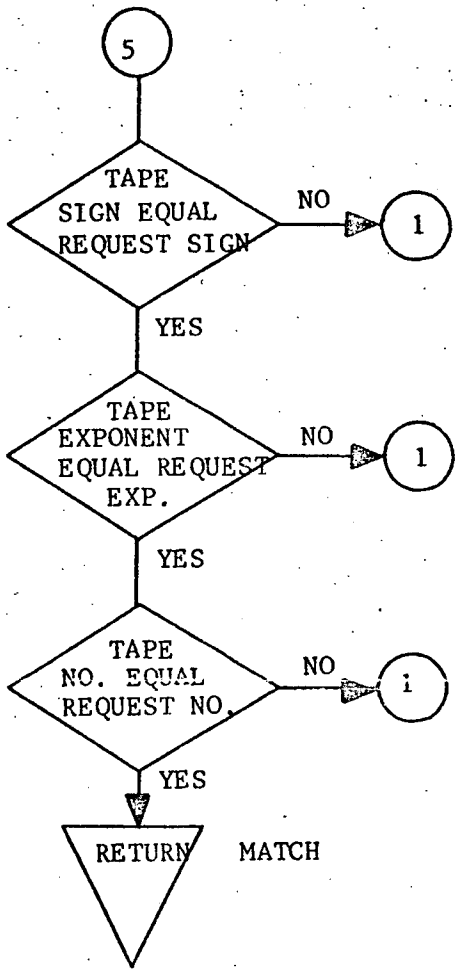

2
COUNT THE NO. OF CHARACTERS IN REQUEST BUFFER
COUNT IN REQUEST EQUAL COUNT IN TAPE BFR
NO
1
YES
REQUEST BUFFER EQUAL TEMP BUFFER
NO
1
YES
COMPARE ON HEADING ONLY
YES
RETURN
MATCH
NO
PROSE DATA
NO
4
YES
FIND START & ENDING ADDRESS OF ANSWER
ANSWER FOUND
NO
1
YES
3

MA00

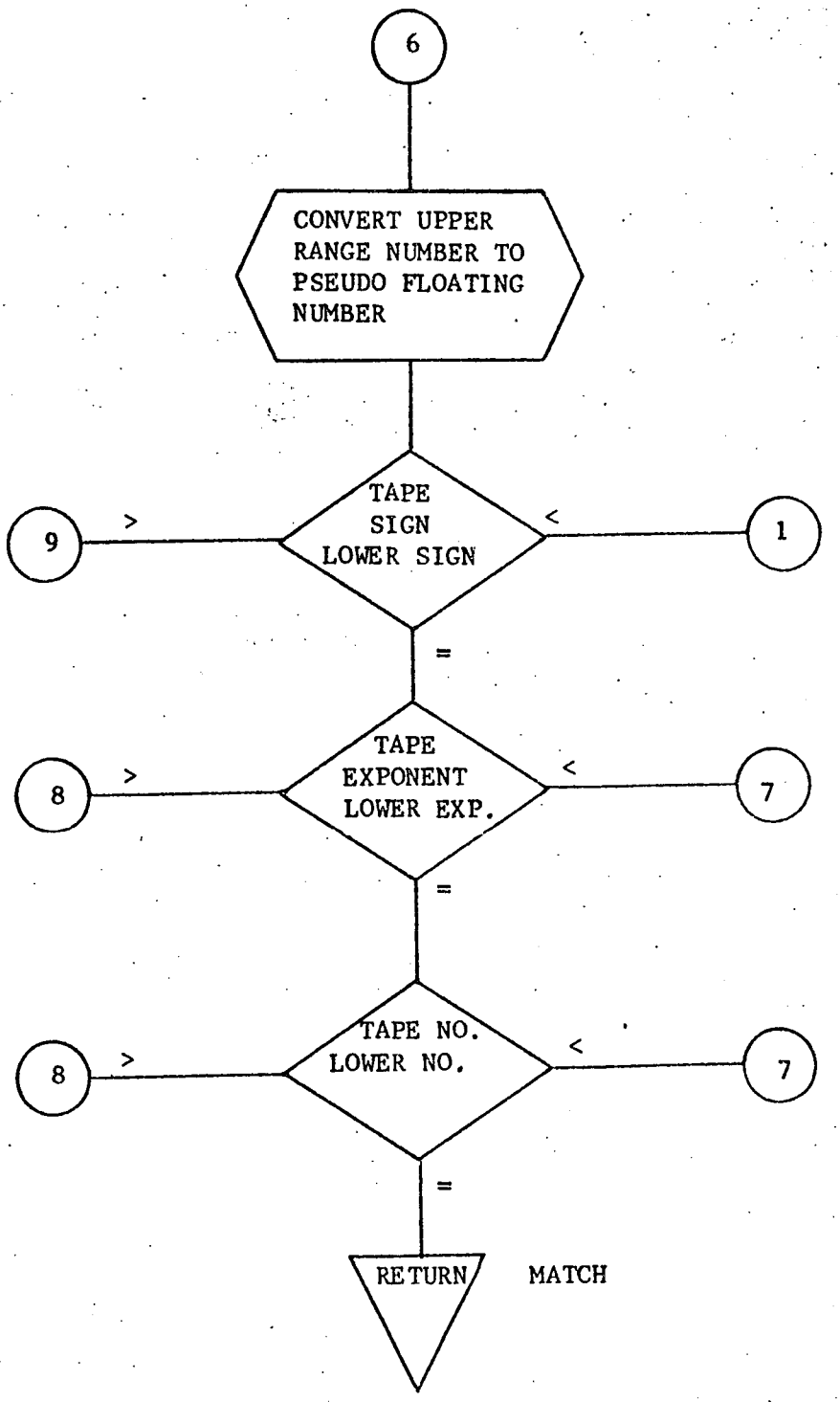

3
DOES REQUEST BUFFER EQUAL TAPE BUFFER POSE
NO
1
YES
RETURN
MATCH


4
CONVERT TAPE BUFFER NUMBER TO PSEUDO FLOATING NUMBER
WAS NUMBER CONVERT
NO
1
YES
CONVERT REQUEST NUMBER TO PSEUDO FLOATING NUMBER
RANGE
YES
6
NO
5

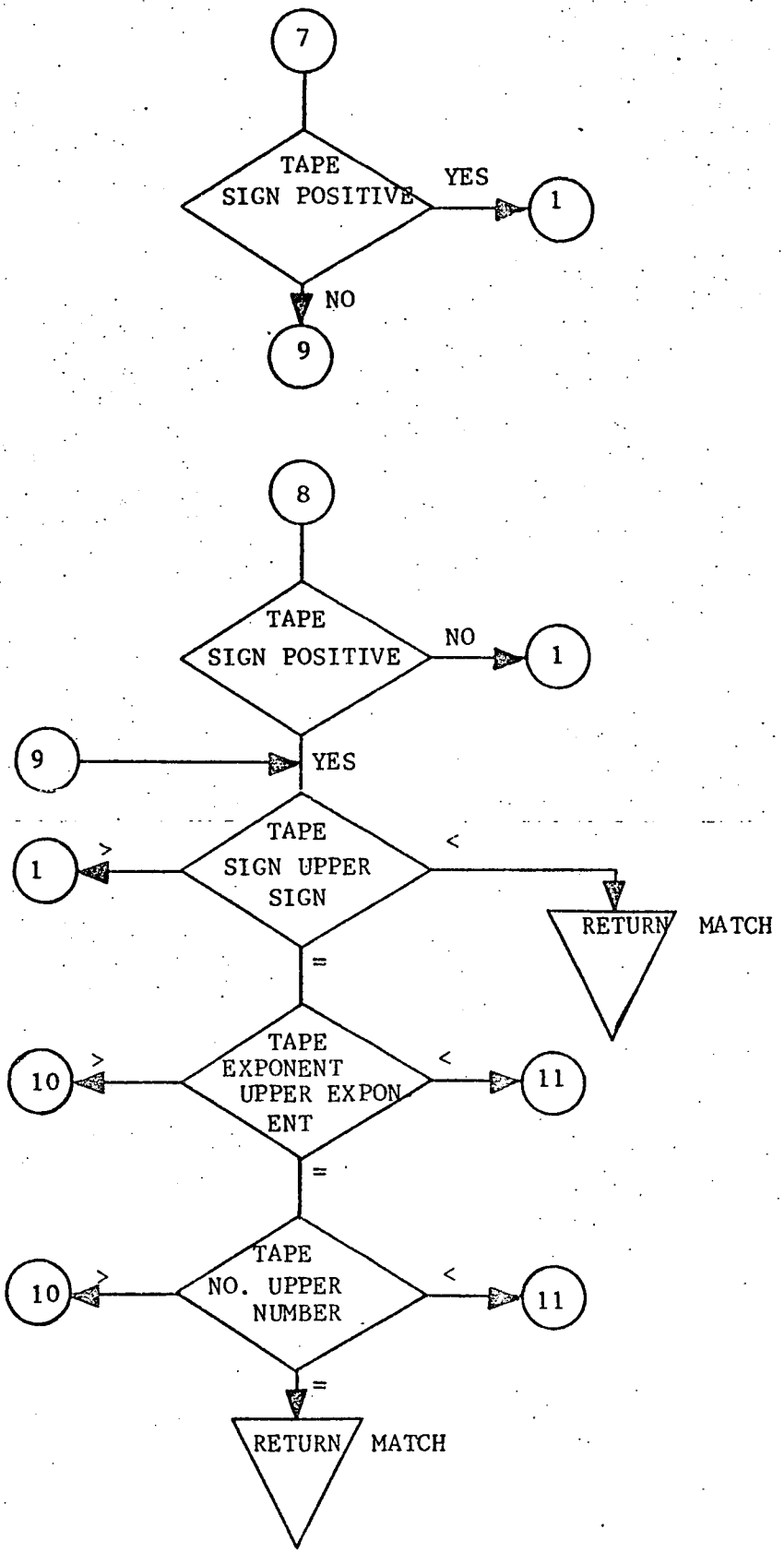
MA00


5
TAPE SIGN EQUAL REQUEST SIGN
NO
1
YES
TAPE EXPONENT EQUAL REQUEST EXP.
NO
1
YES
TAPE NO. EQUAL REQUEST NO.
NO
i
YES
RETURN
MATCH

MA00

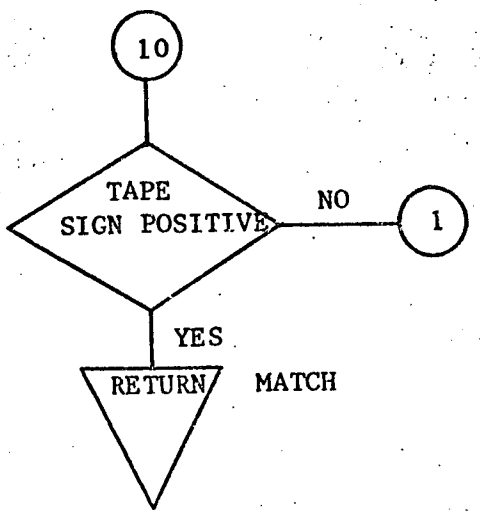

6
CONVERT UPPER RANGE NUMBER TO PSEUDO FLOATING NUMBER
TAPE SIGN LOWER SIGN
9
>
<
1
=
TAPE EXPONENT LOWER EXP.
8
>
<
7
=
TAPE NO. LOWER NO.
8
>
<
7
=
RETURN
MATCH

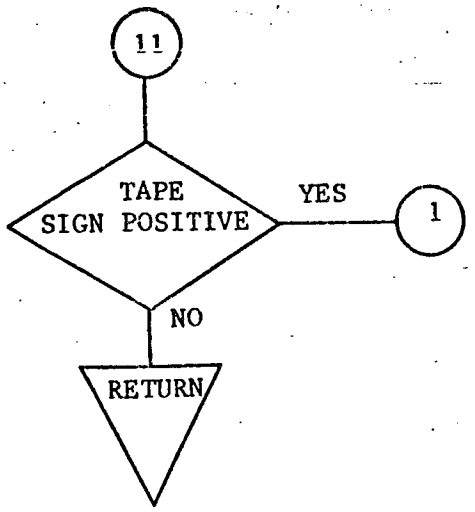
MA00


7
TAPE
SIGN POSITIVE
YES
1
NO
9
8
TAPE
SIGN POSITIVE
NO
1
9
YES
TAPE
SIGN UPPER
SIGN
>
1
<
RETURN
MATCH
=
TAPE
EXPONENT
UPPER EXPON
ENT
>
10
<
11
=
TAPE
NO. UPPER
NUMBER
>
10
<
11
=
RETURN
MATCH

MA00

5A


10
TAPE
SIGN POSITIVE
NO
1
YES
RETURN
MATCH


11
TAPE
SIGN POSITIVE
YES
1
NO
RETURN

MA00

3.3.17.3 Label Description

3.3.17.3.1 Local

MABA	Address of the Number to Convert Pseudo Floating Point
MABI	(Heading Number -1)*12 Used to calculate Base Address of Heading in Tape Buffer
MACT	Working Counter
MADS	Decimal Point Switch for Pseudo Floating Point
MAEC	Terminate Character to Check for in Subroutine MA55
MAFP	Address of Flag
MAFW	Pointer to Heading Answer in Tape Buffer
MAF6	Two Characters of Pack ASCII Zero
MAHB	Area where Tape Header is Stored
MAHD	Address of Heading Number
MAHN	Heading Number
MAI1	Number of Character of Heading in the Tape Buffer
MAI2	Number of Characters of Heading in Request Buffer
MAI3	Working Storage used to Store Total Count Address for Pseudo Floating Point
MAI4	Working Storage used to Store Exponent Address for Pseudo Floating Point
MALM	Ending Address of Answer in Tape Buffer
MANS	Beginning Address of Answer in Tape Buffer
MAOP	Address of Pointer to Operand Buffer
MAPP	Set to 1 when there is an Odd Number of Characters in Heading

3.3.17.3.1 Local (Continued)

MAPS Working Storage

MAQ1 (Heading Number 01)*3 Used to Calculate Base Address of Heading Answer in Tape Buffer

MASI Address of Sign of Pseudo Floating Point

MASW Address of Packet Switch

MAW1 Working Storage for Temporary Calculation

MAW2 Working Storage for Temporary Calculation

MAXX Index when Odd Character is in Request Buffer and MAHB

MASW Switch Indicate which part to Unpack

MAZS Leading Zero Switch for Pseudo Floating Point

3.3.17.3.2 Globe

MAHE High Exponent for Floating Point Number

MAHL High Count for Pseudo Floating Point Number

MAHM High Pseudo Floating Point Number

MAHS High Sign for Pseudo Floating Point Number

MALC Low Count for Pseudo Floating Point Number

MALE Low Exponent for Pseudo Floating Point Number

MALF Low Pseudo Floating Point Number

MALS Low Sign for Pseudo Floating Point Number

MAS1 Switch set to Non Zero on No Match Condition. Referenced by TA00

MATE Tape Exponent, Number of Digits to Left of Decimal Point

MATL Tape Count of Number of Digits of Pseudo Floating Point Number

MATM Tape Pseudo Floating Point Number

MATS Tape Sign Word 0, Positive; -1 Negative

3.3.17.3.3 Entry Point

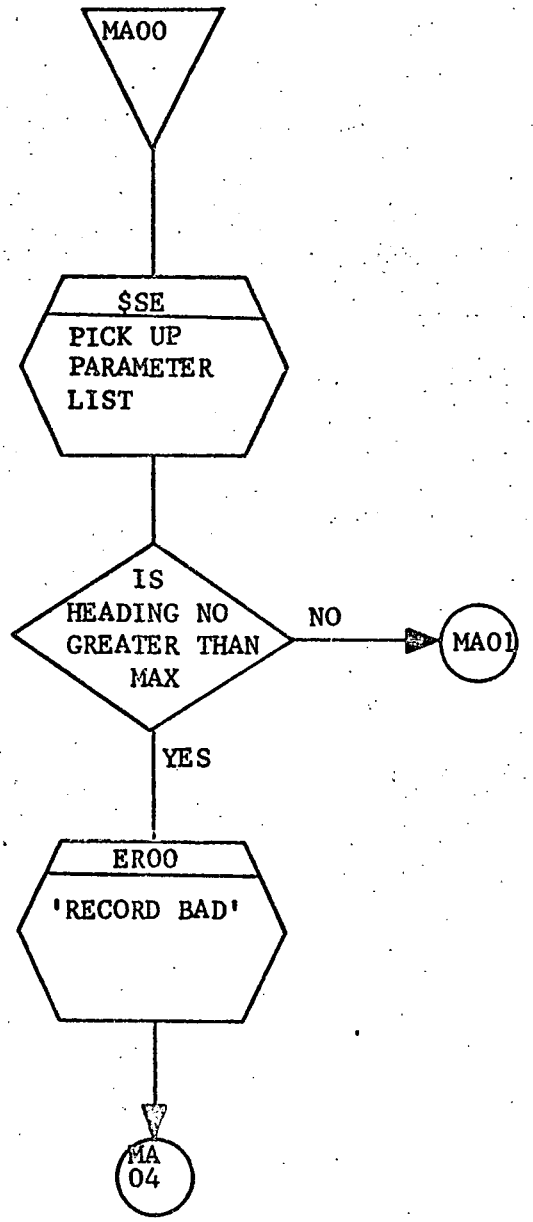
MABO

MAOO

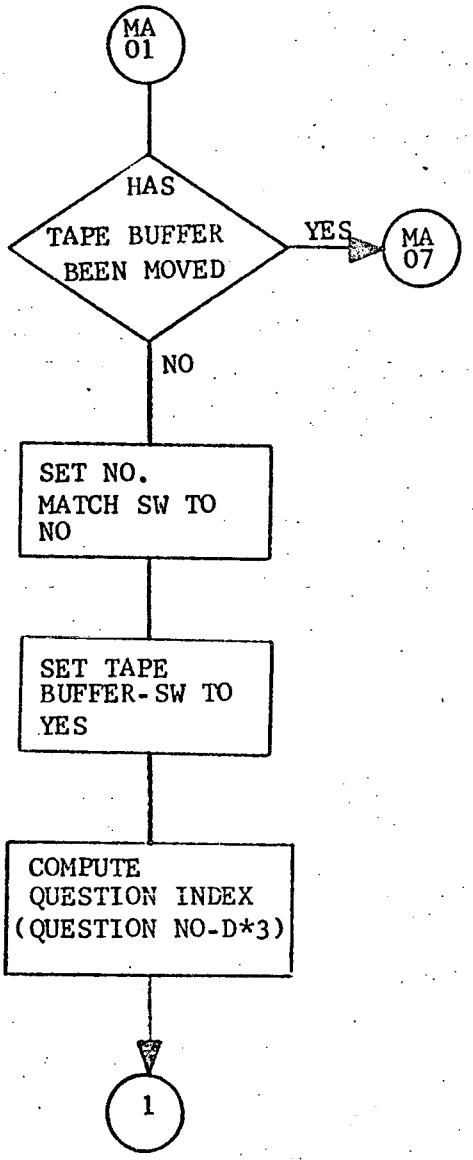
3.3.17.3.4 External References

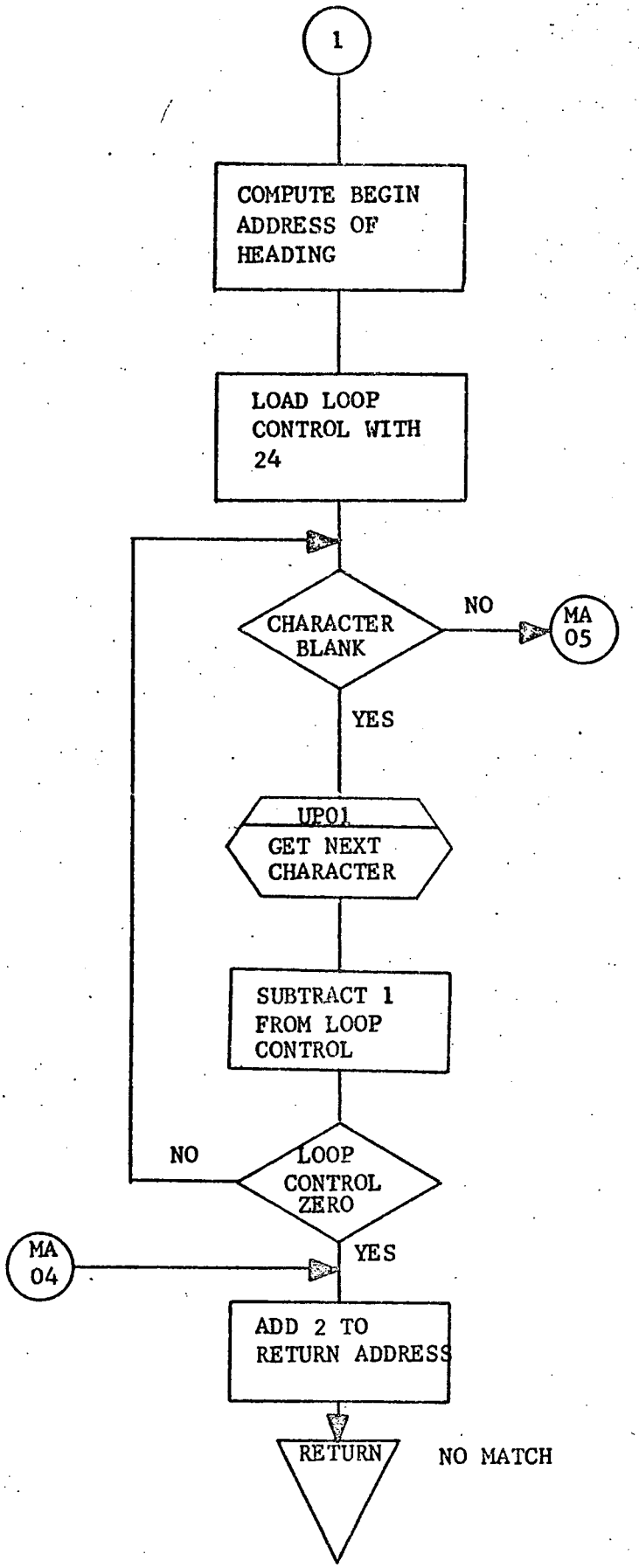
CMOO	Compare Subroutine
CPTB	Table Buffer, See Appendix for Details
FILL	Subroutine to Fill Buffer
PKOO	Entry Point of Subroutine to Pack First Character of Buffer
PKO1	Entry Point of Subroutine to Pack Characters in Buffer
UPOO	Entry Point of Subroutine to Unpack First Character of Buffer
UPO1	Entry Point of Subroutine to Unpack Characters in a Buffer
$SE	Subroutine to Store Parameter List

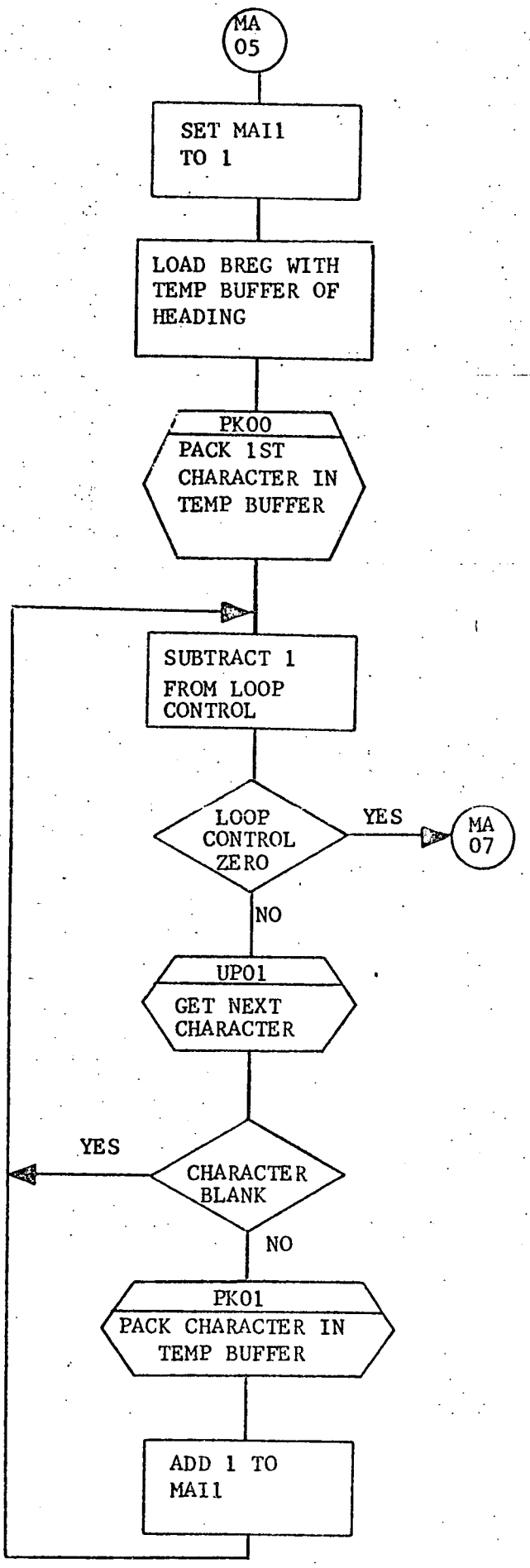
3.3.17.4 Detailed Flow Chart

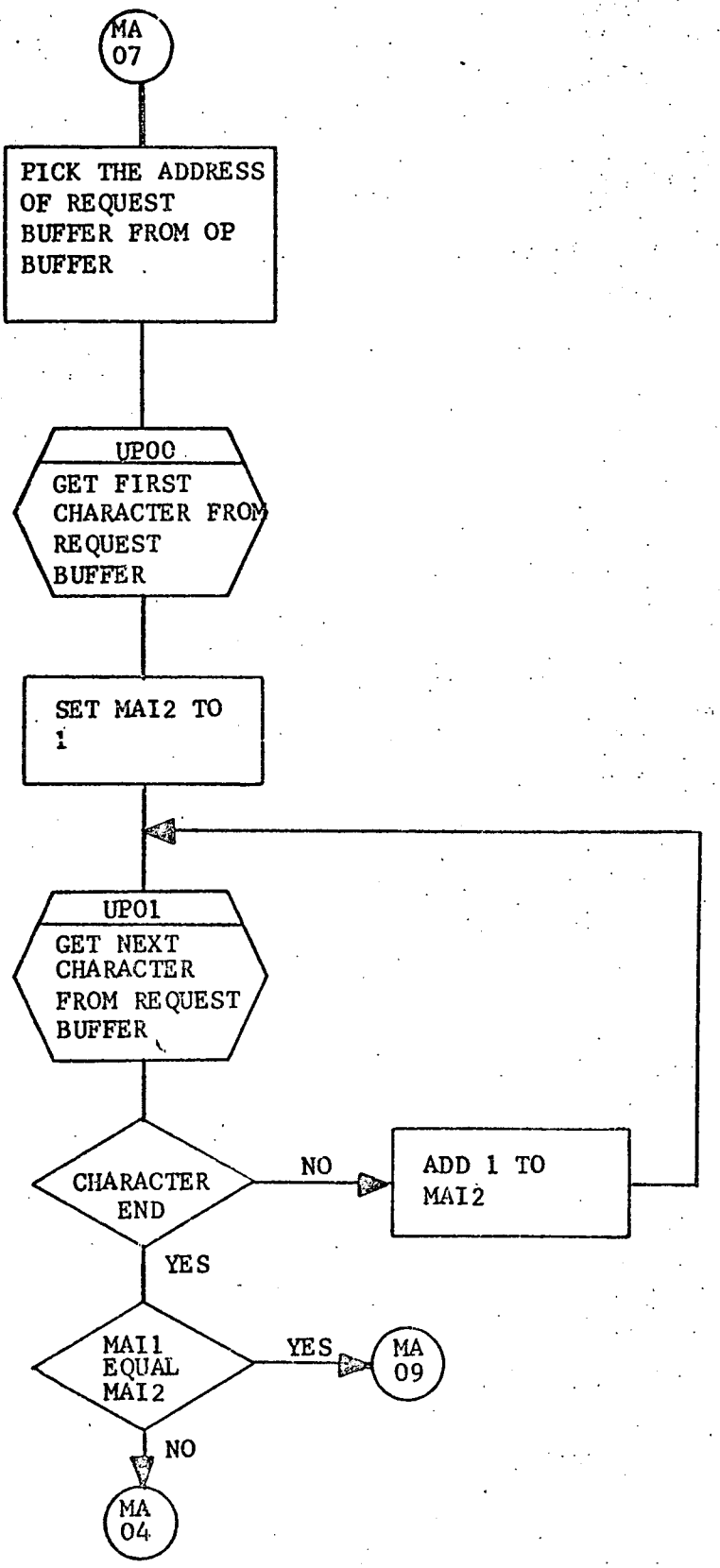


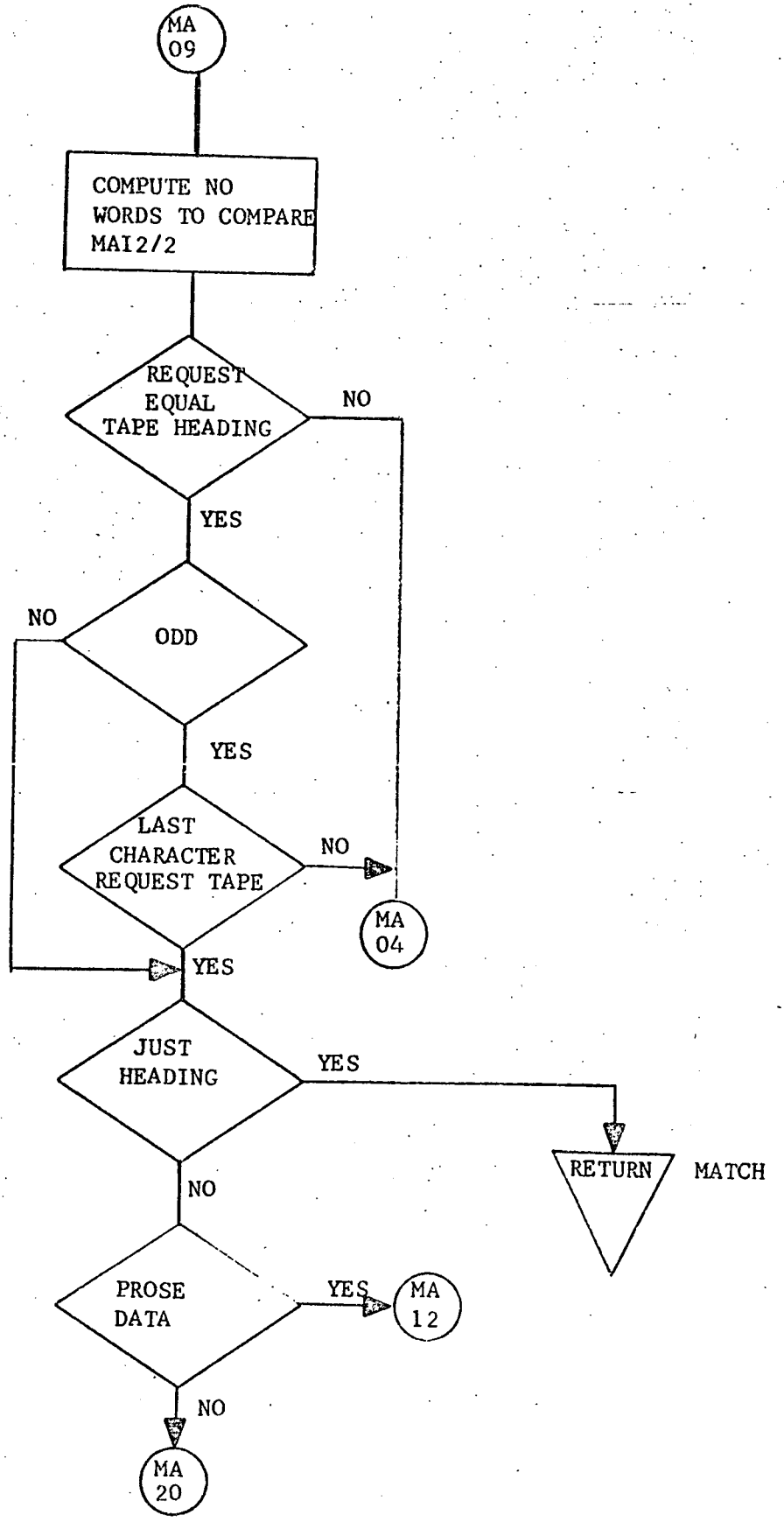
MA00

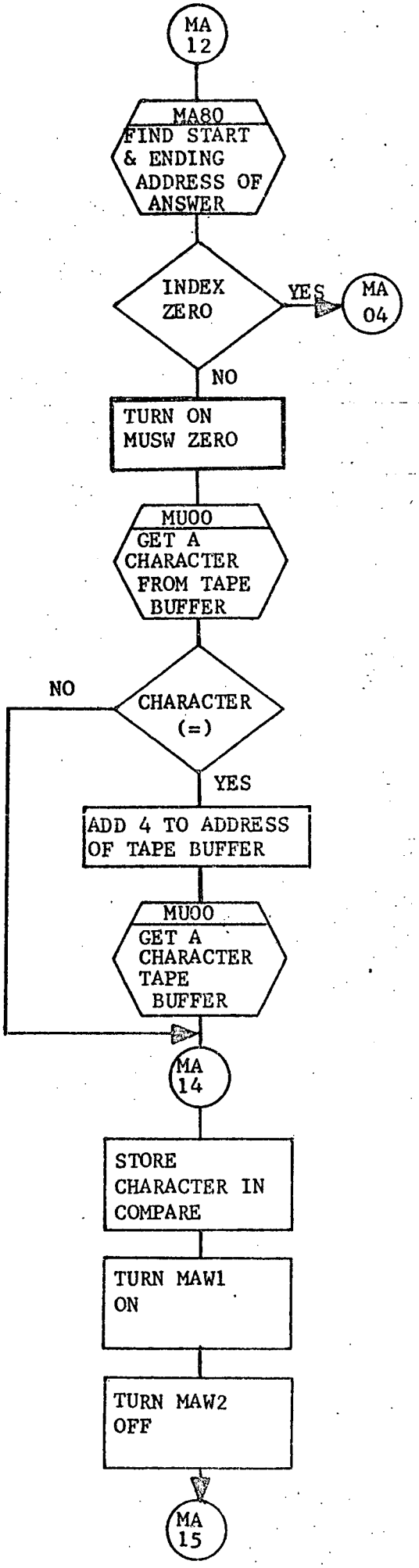

MA
01
HAS
TAPE BUFFER
BEEN MOVED
YES
MA
07
NO
SET NO.
MATCH SW TO
NO
SET TAPE
BUFFER-SW TO
YES
COMPUTE
QUESTION INDEX
(QUESTION NO-D*3)
1

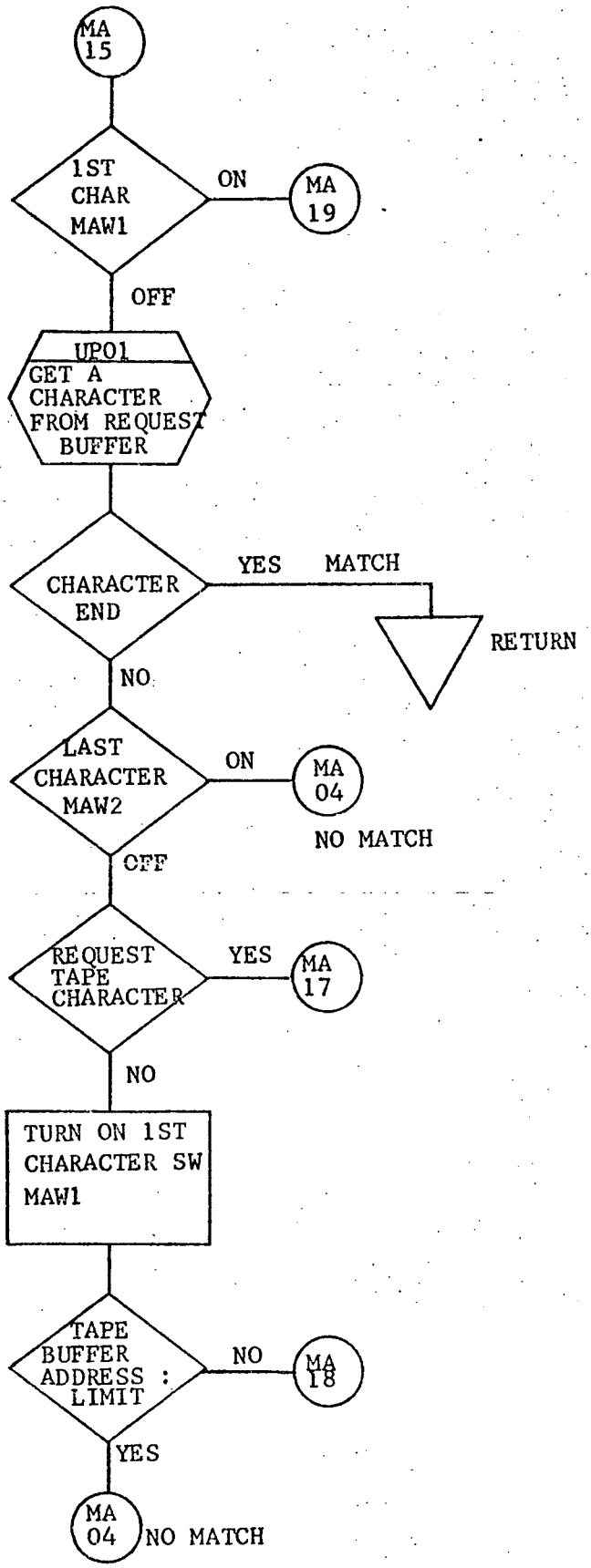

1
COMPUTE BEGIN ADDRESS OF HEADING
LOAD LOOP CONTROL WITH 24
CHARACTER BLANK
NO
MA 05
YES
UP01
GET NEXT CHARACTER
SUBTRACT 1 FROM LOOP CONTROL
NO
LOOP CONTROL ZERO
YES
MA 04
ADD 2 TO RETURN ADDRESS
RETURN
NO MATCH

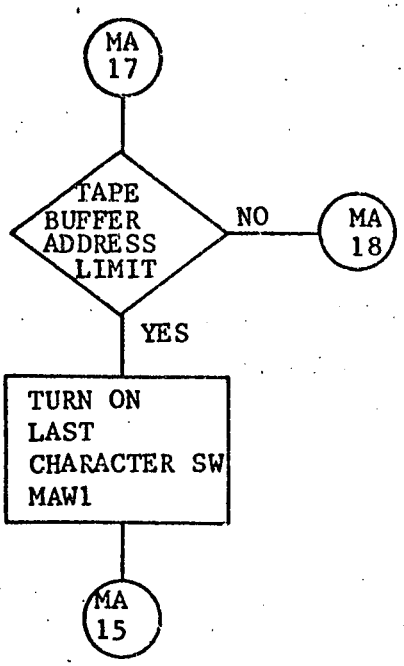

MA
05
SET MAI1
TO 1
LOAD BREG WITH
TEMP BUFFER OF
HEADING
PK00
PACK 1ST
CHARACTER IN
TEMP BUFFER
SUBTRACT 1
FROM LOOP
CONTROL
LOOP
CONTROL
ZERO
YES
MA
07
NO
UP01
GET NEXT
CHARACTER
YES
CHARACTER
BLANK
NO
PK01
PACK CHARACTER IN
TEMP BUFFER
ADD 1 TO
MAI1

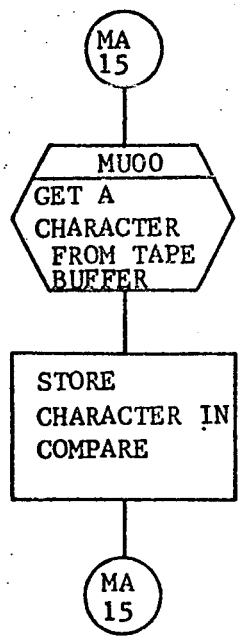

MA
07
PICK THE ADDRESS OF REQUEST BUFFER FROM OP BUFFER
UP00
GET FIRST CHARACTER FROM REQUEST BUFFER
SET MAI2 TO 1
UP01
GET NEXT CHARACTER FROM REQUEST BUFFER
CHARACTER END
NO
ADD 1 TO MAI2
YES
MAI1 EQUAL MAI2
YES
MA
09
NO
MA
04

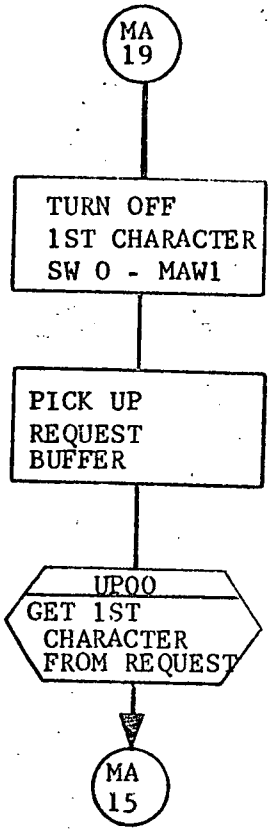

MA 09
COMPUTE NO WORDS TO COMPARE MAI2/2
REQUEST EQUAL TAPE HEADING
NO
YES
ODD
NO
YES
LAST CHARACTER REQUEST TAPE
NO
MA 04
YES
JUST HEADING
YES
RETURN
MATCH
NO
PROSE DATA
YES
MA 12
NO
MA 20

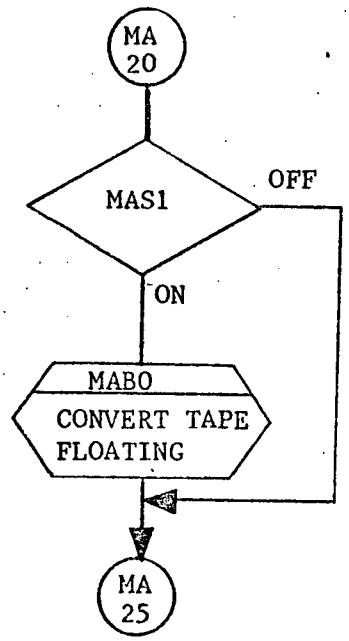

MA 12
MA80
FIND START & ENDING ADDRESS OF ANSWER
INDEX ZERO
YES
MA 04
NO
TURN ON MUSW ZERO
MU00
GET A CHARACTER FROM TAPE BUFFER
NO
CHARACTER (=)
YES
ADD 4 TO ADDRESS OF TAPE BUFFER
MU00
GET A CHARACTER TAPE BUFFER
MA 14
STORE CHARACTER IN COMPARE
TURN MAW1 ON
TURN MAW2 OFF
MA 15

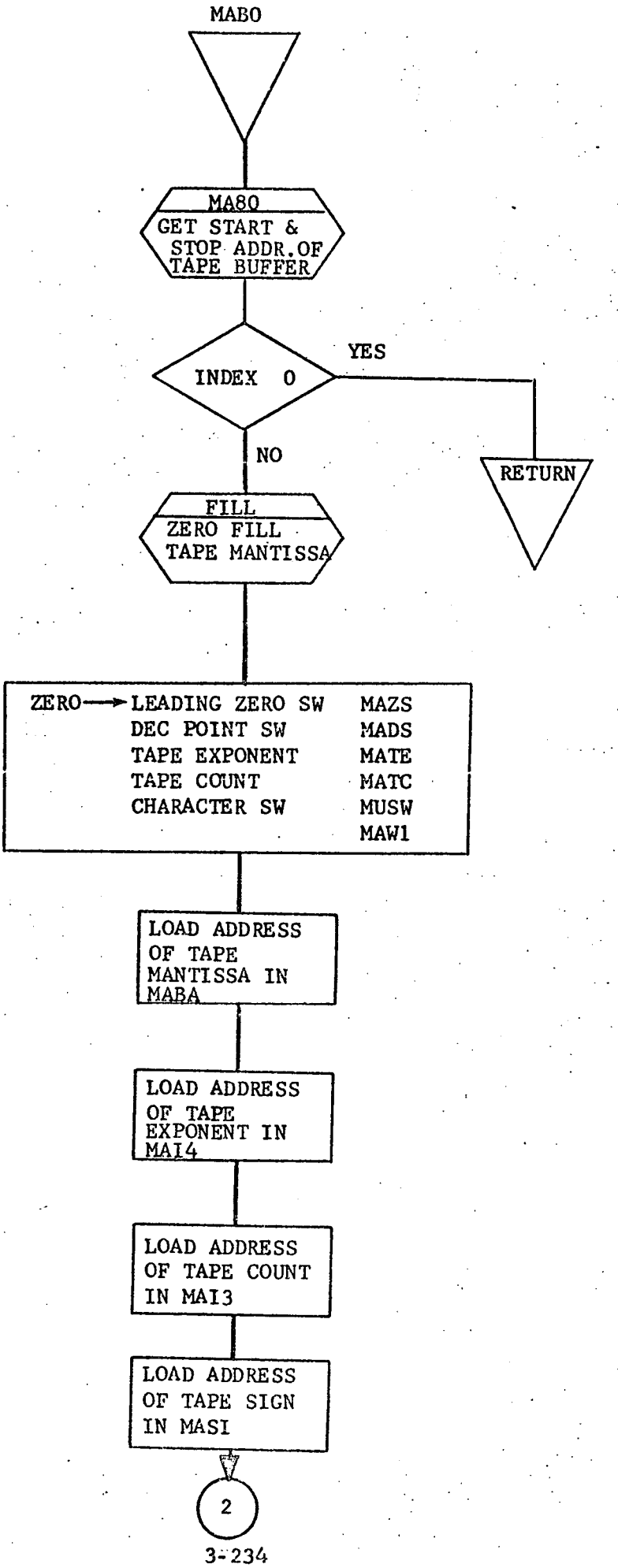

MA 15
1ST CHAR MAW1
ON
MA 19
OFF
UP01
GET A CHARACTER FROM REQUEST BUFFER
CHARACTER END
YES MATCH
RETURN
NO
LAST CHARACTER MAW2
ON
MA 04
NO MATCH
OFF
REQUEST TAPE CHARACTER
YES
MA 17
NO
TURN ON 1ST CHARACTER SW MAW1
TAPE BUFFER ADDRESS : LIMIT
NO
MA 18
YES
MA 04
NO MATCH

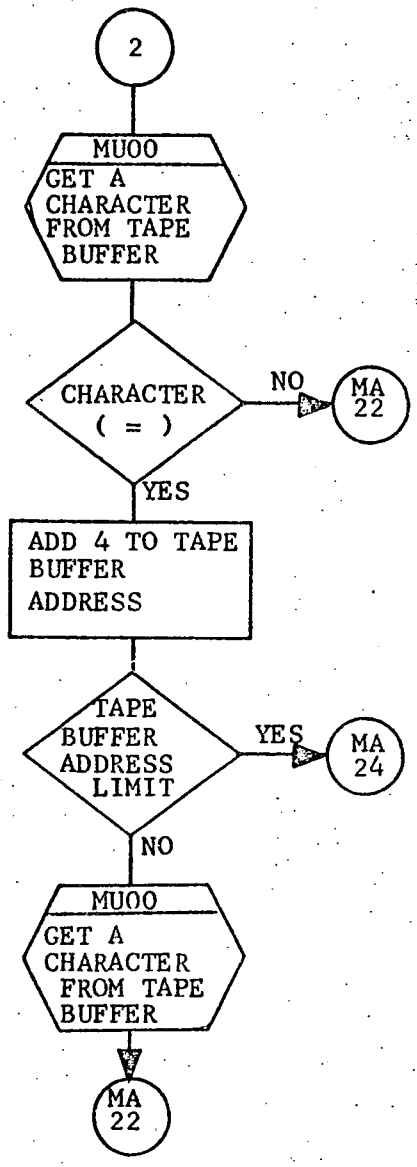

MA
17
TAPE
BUFFER
ADDRESS
LIMIT
NO
MA
18
YES
TURN ON
LAST
CHARACTER SW
MAW1
MA
15

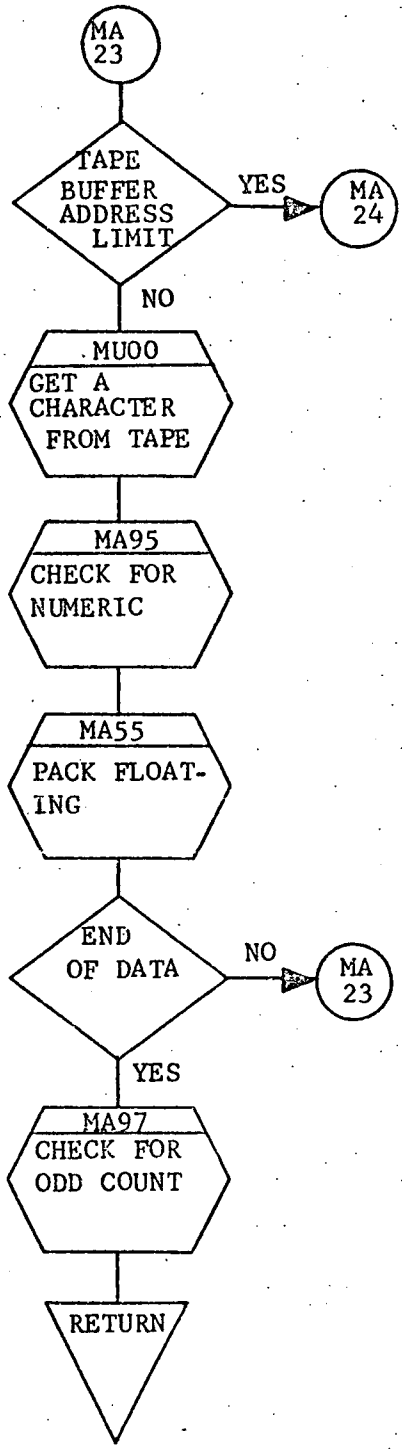

MA
15
MU00
GET A
CHARACTER
FROM TAPE
BUFFER
STORE
CHARACTER IN
COMPARE
MA
15

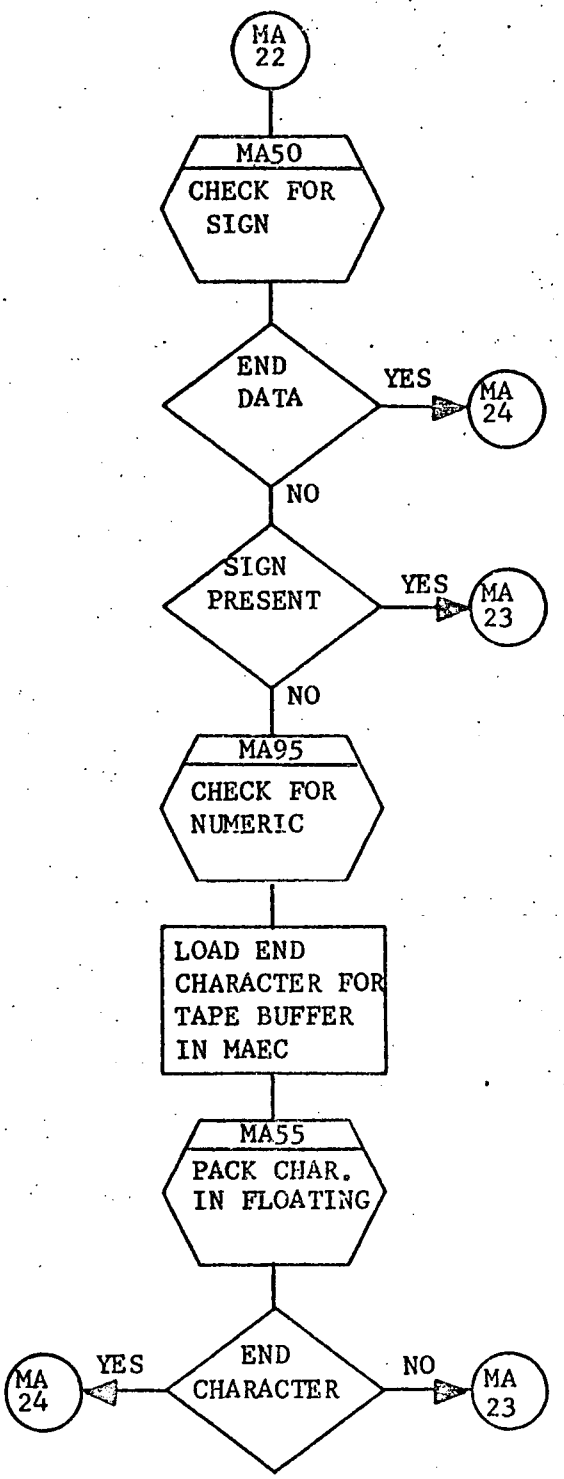

MA
19
TURN OFF
1ST CHARACTER
SW 0 - MAW1
PICK UP
REQUEST
BUFFER
UP00
GET 1ST
CHARACTER
FROM REQUEST
MA
15

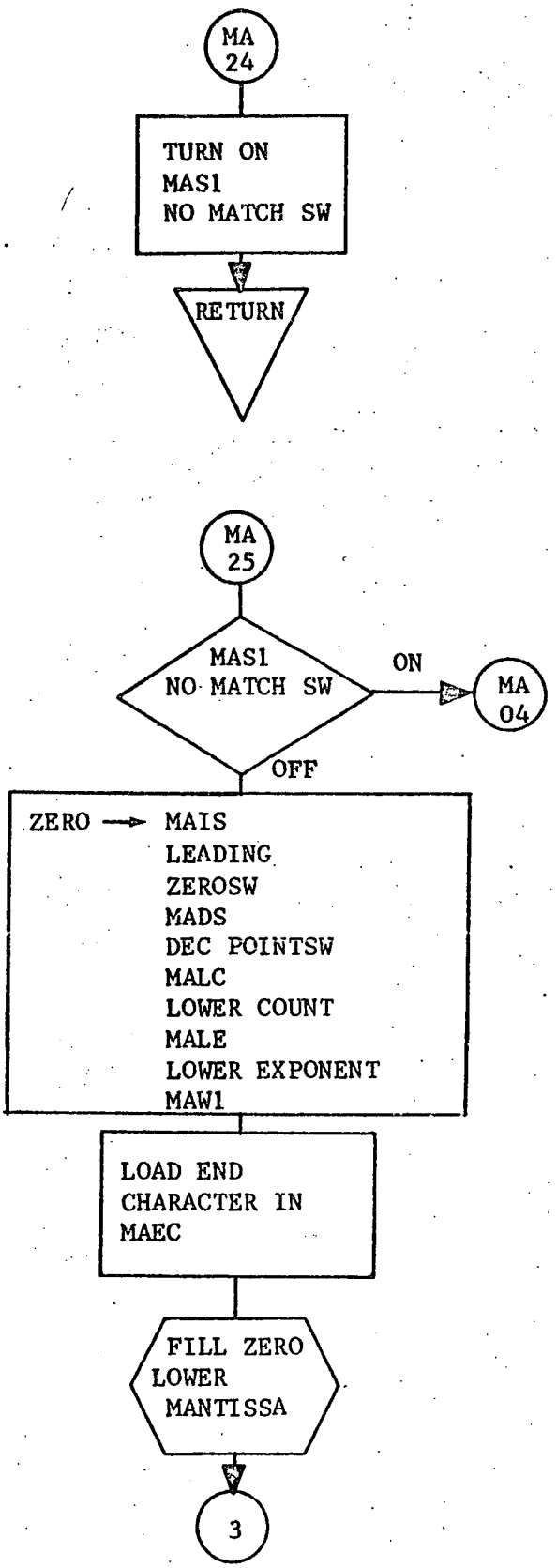

MA
20
MAS1
OFF
ON
MAB0
CONVERT TAPE
FLOATING
MA
25

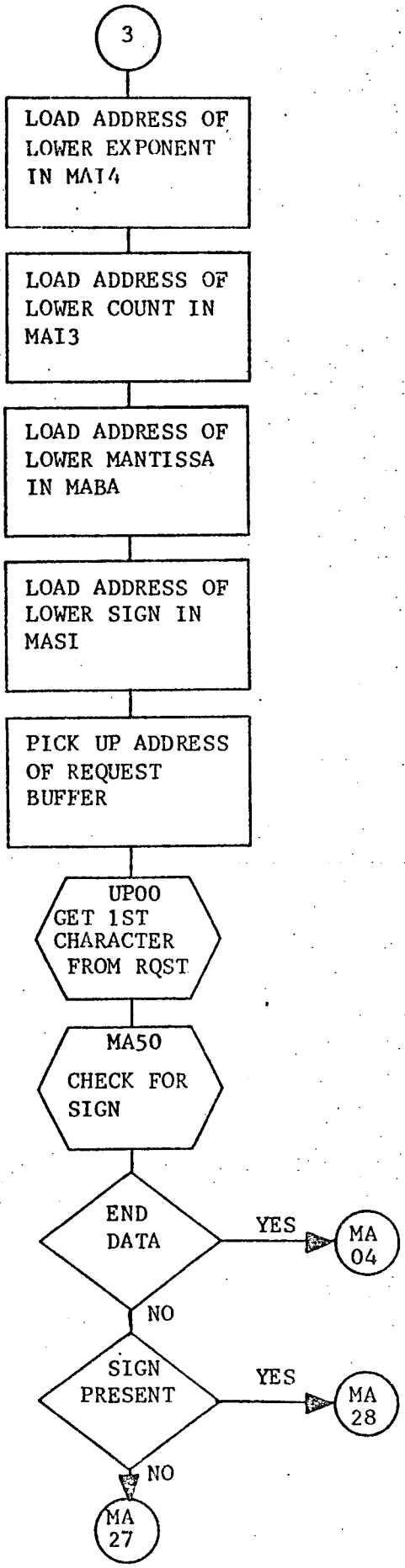

MABO
MA80
GET START &
STOP ADDR.OF
TAPE BUFFER
INDEX 0
YES
NO
RETURN
FILL
ZERO FILL
TAPE MANTISSA
ZERO
LEADING ZERO SW MAZS
DEC POINT SW MADS
TAPE EXPONENT MATE
TAPE COUNT MATC
CHARACTER SW MUSW
MAW1
LOAD ADDRESS
OF TAPE
MANTISSA IN
MABA
LOAD ADDRESS
OF TAPE
EXPONENT IN
MAI4
LOAD ADDRESS
OF TAPE COUNT
IN MAI3
LOAD ADDRESS
OF TAPE SIGN
IN MASI
2

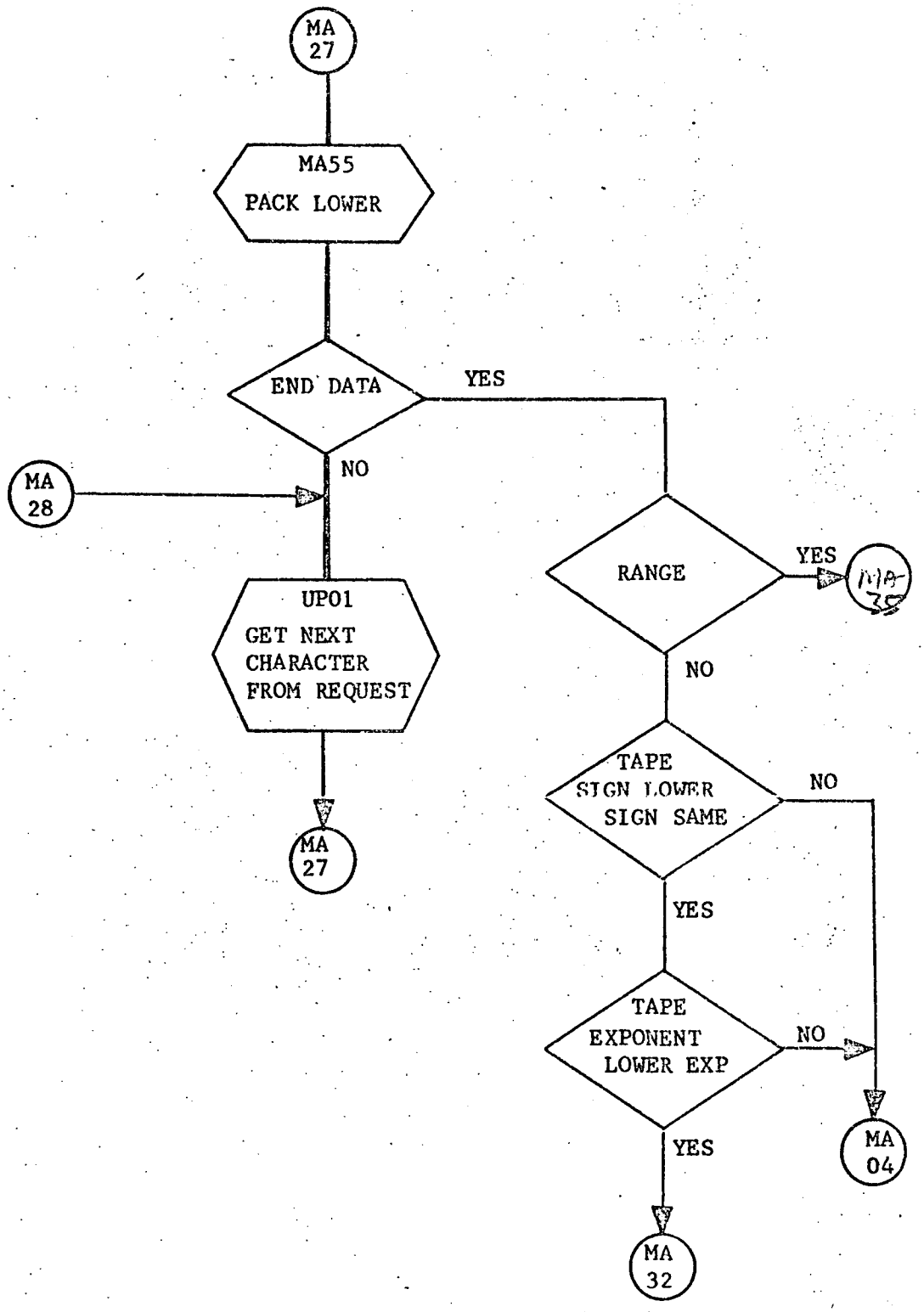

2
MU00
GET A CHARACTER FROM TAPE BUFFER
CHARACTER (=)
NO
MA 22
YES
ADD 4 TO TAPE BUFFER ADDRESS
TAPE BUFFER ADDRESS LIMIT
YES
MA 24
NO
MU00
GET A CHARACTER FROM TAPE BUFFER
MA 22

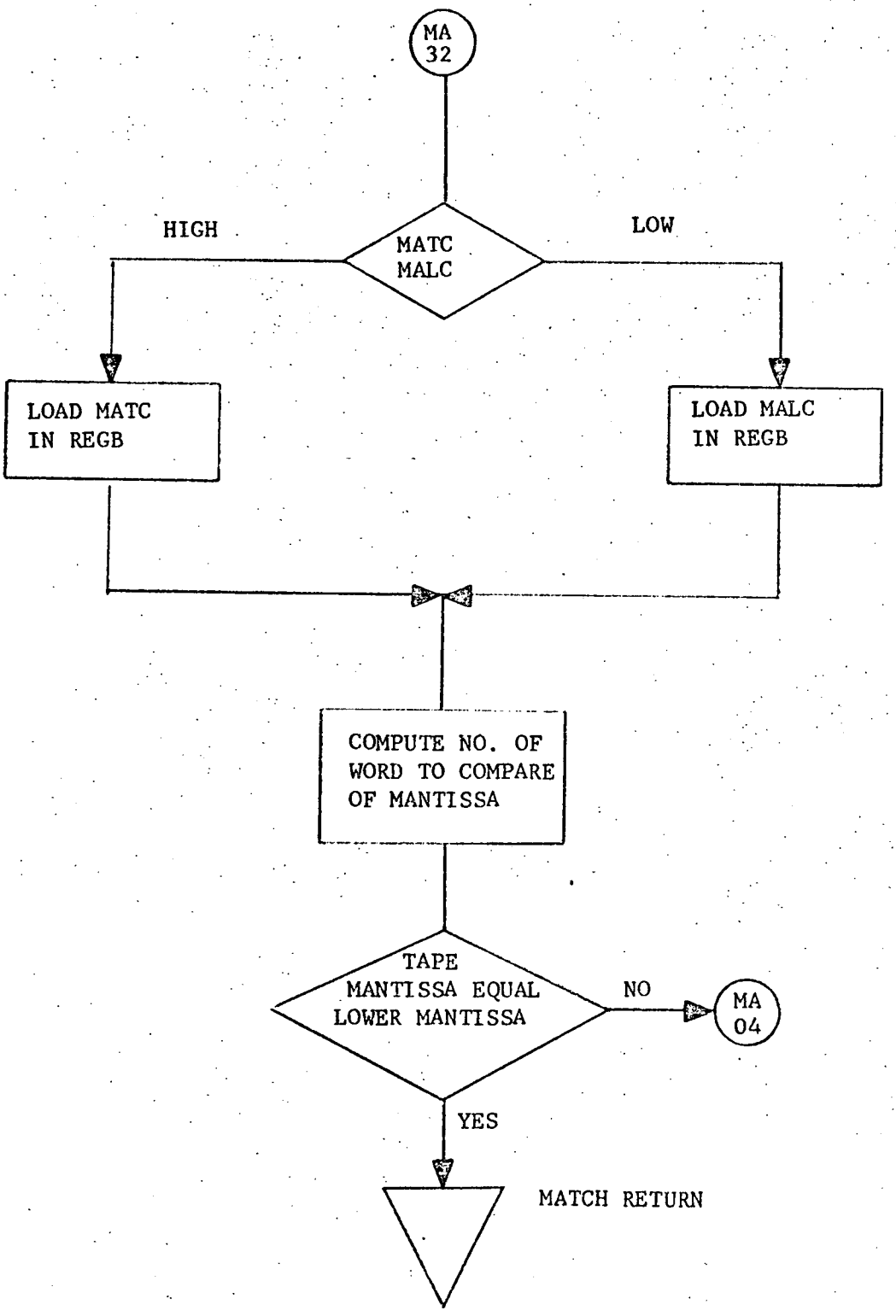

MA
23
TAPE
BUFFER
ADDRESS
LIMIT
YES
MA
24
NO
.MU00
GET A
CHARACTER
FROM TAPE
MA95
CHECK FOR
NUMERIC
MA55
PACK FLOAT-
ING
END
OF DATA
NO
MA
23
YES
MA97
CHECK FOR
ODD COUNT
RETURN

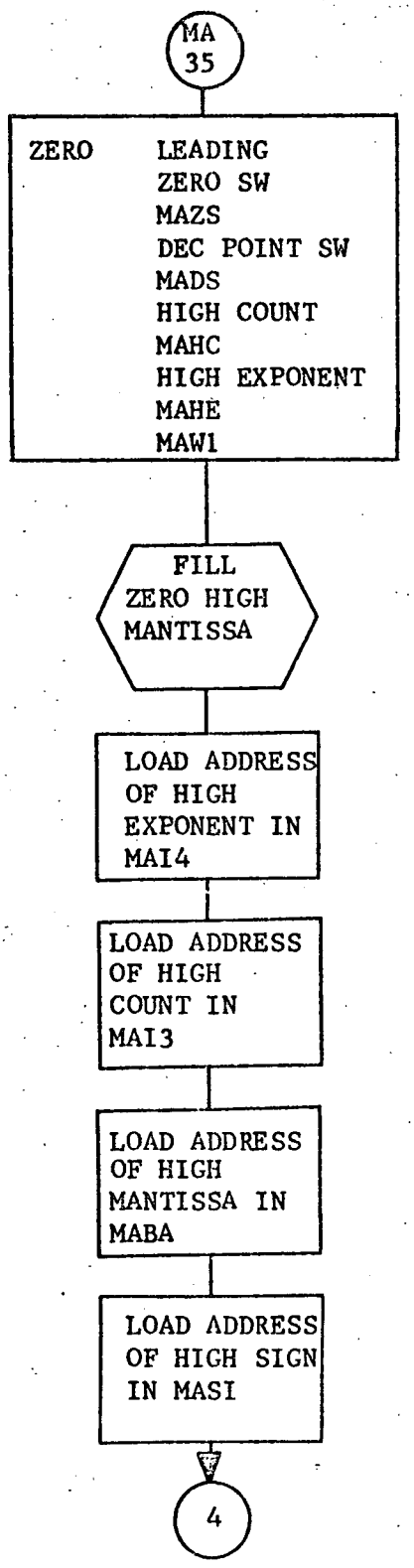

MA 22
MA50
CHECK FOR SIGN
END DATA
YES
MA 24
NO
SIGN PRESENT
YES
MA 23
NO
MA95
CHECK FOR NUMERIC
LOAD END CHARACTER FOR TAPE BUFFER IN MAEC
MA55
PACK CHAR. IN FLOATING
END CHARACTER
YES
MA 24
NO
MA 23

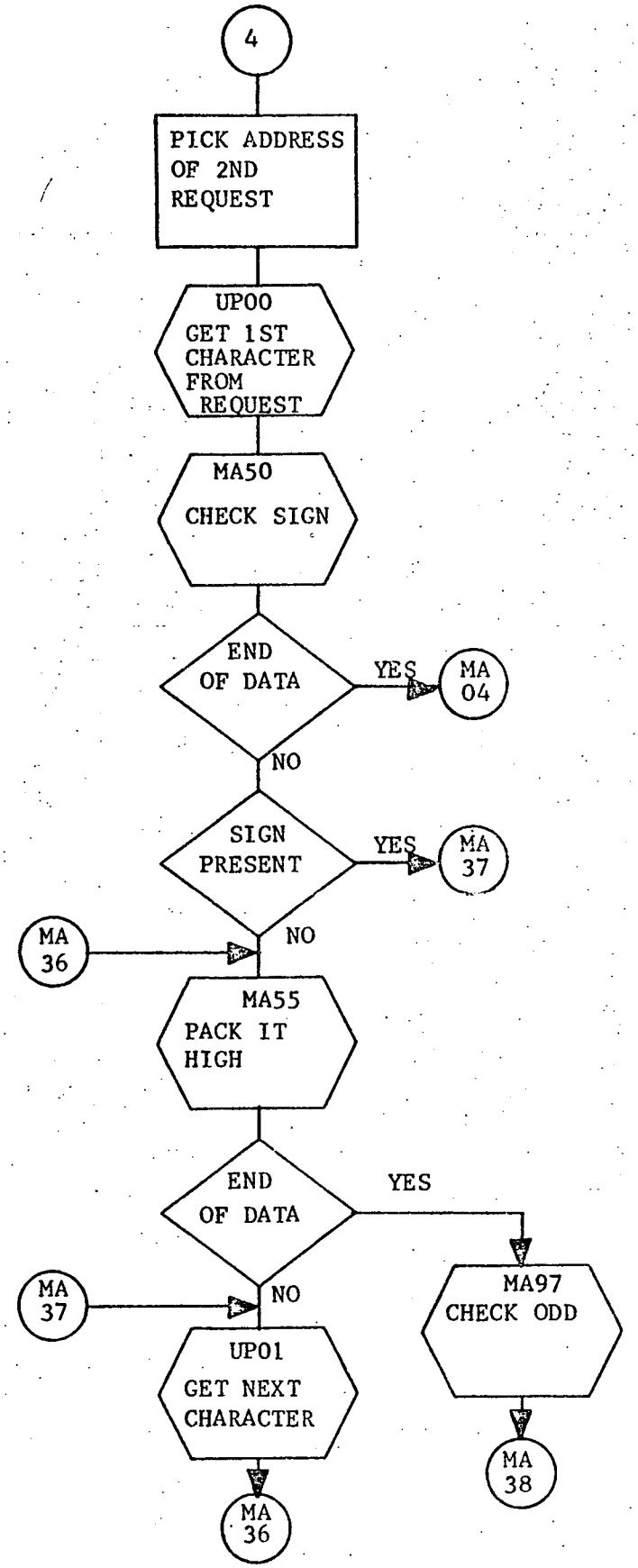

MA
24
TURN ON
MAS1
NO MATCH SW
RETURN
MA
25
MAS1
NO MATCH SW
ON
MA
04
OFF
ZERO
MAIS
LEADING
ZEROSW
MADS
DEC POINTSW
MALC
LOWER COUNT
MALE
LOWER EXPONENT
MAW1
LOAD END
CHARACTER IN
MAEC
FILL ZERO
LOWER
MANTISSA
3

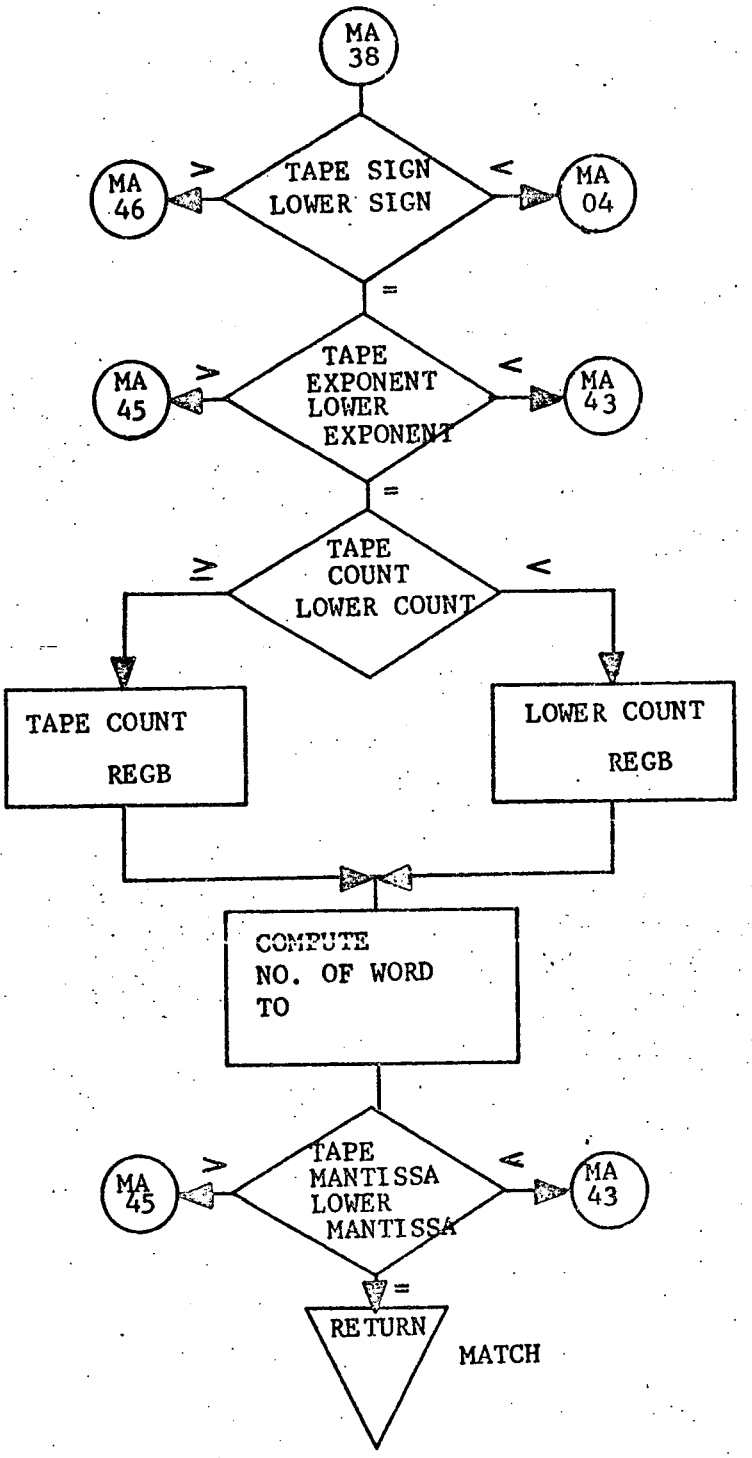

3
LOAD ADDRESS OF LOWER EXPONENT IN MAI4
LOAD ADDRESS OF LOWER COUNT IN MAI3
LOAD ADDRESS OF LOWER MANTISSA IN MABA
LOAD ADDRESS OF LOWER SIGN IN MASI
PICK UP ADDRESS OF REQUEST BUFFER
UP00
GET 1ST CHARACTER FROM RQST
MA50
CHECK FOR SIGN
END DATA
YES
MA 04
NO
SIGN PRESENT
YES
MA 28
NO
MA 27

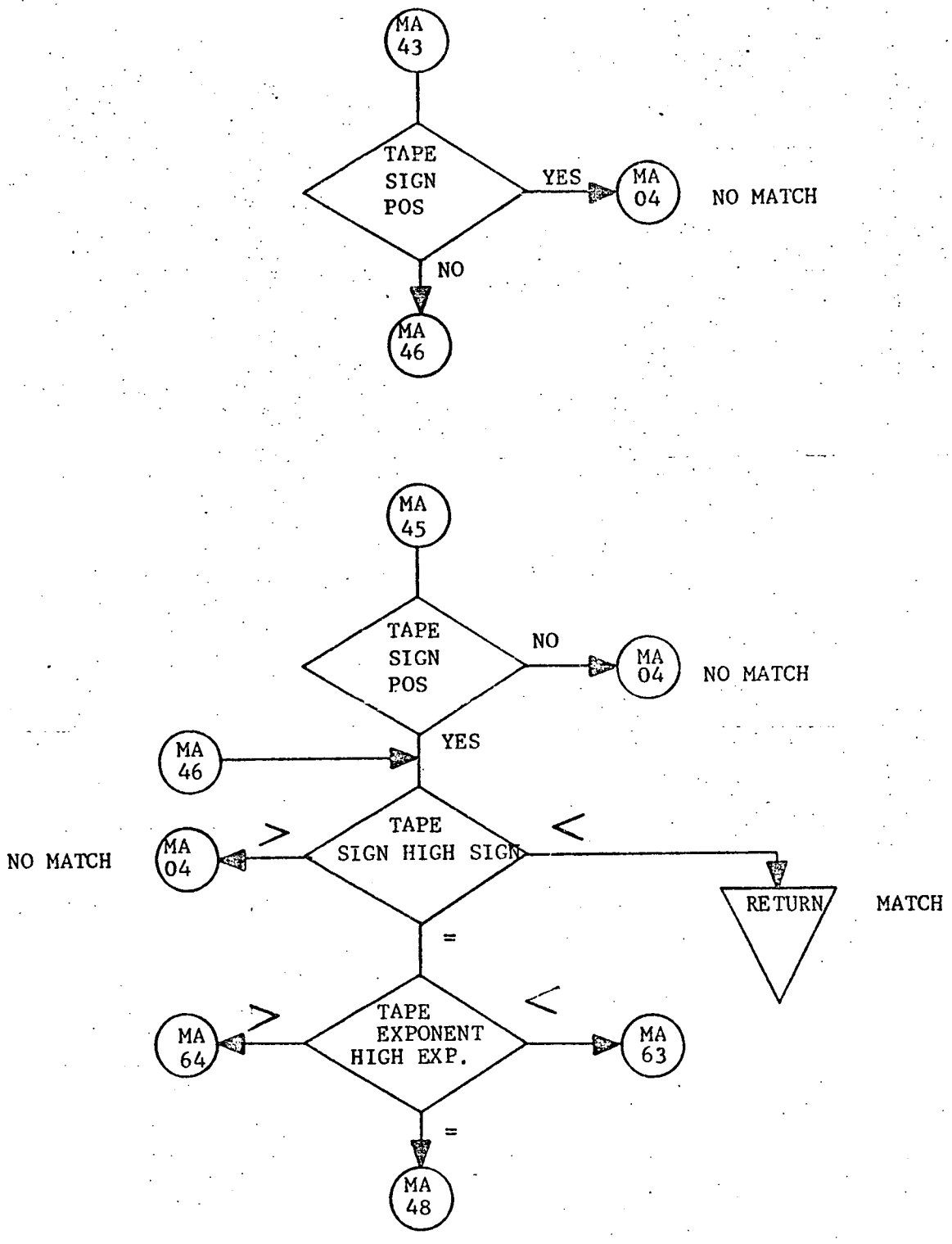

MA 27
MA55
PACK LOWER
END DATA
YES
NO
MA 28
UP01
GET NEXT
CHARACTER
FROM REQUEST
MA 27
RANGE
YES
NO
TAPE
SIGN LOWER
SIGN SAME
NO
YES
TAPE
EXPONENT
LOWER EXP
NO
YES
MA 04
MA 32

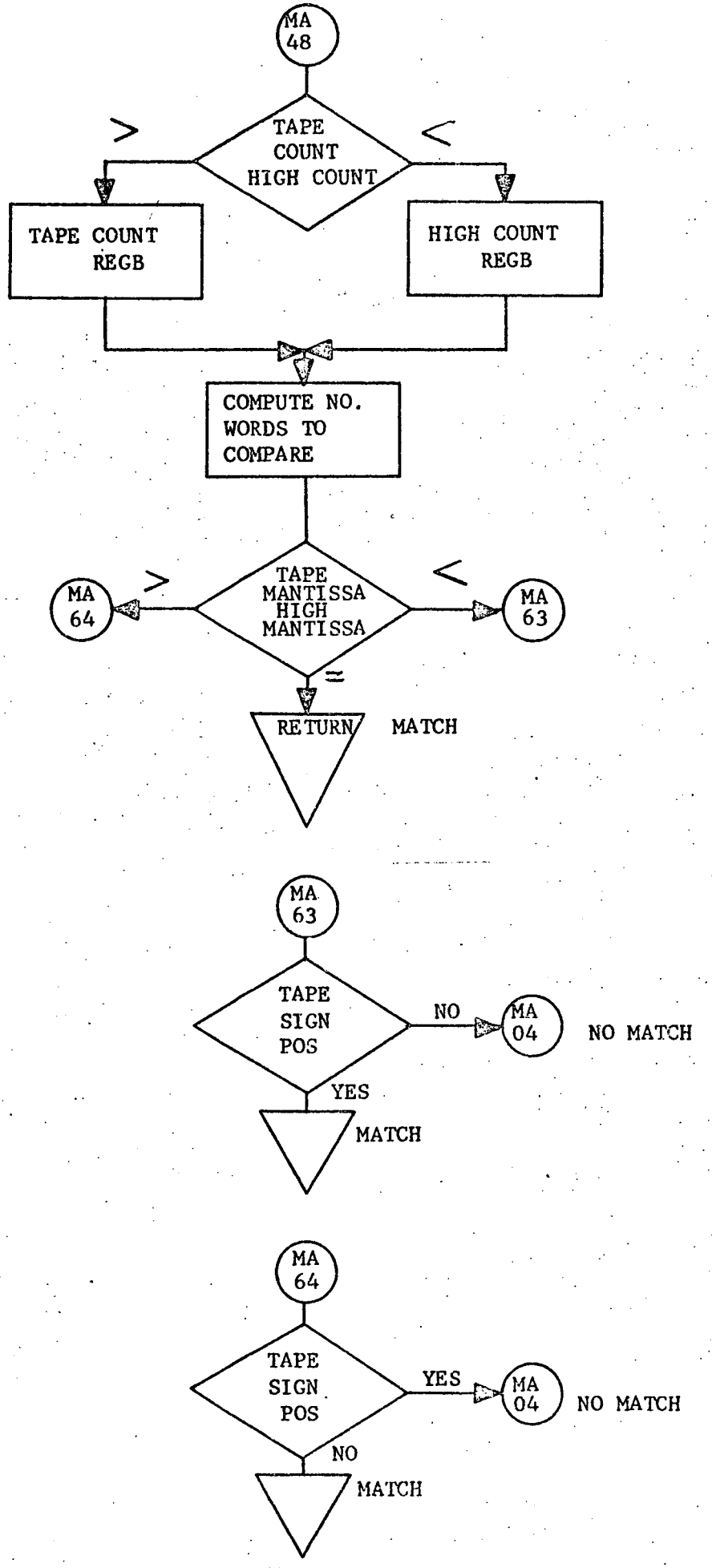

MA
32
HIGH
MATC
MALC
LOW
LOAD MATC
IN REGB
LOAD MALC
IN REGB
COMPUTE NO. OF
WORD TO COMPARE
OF MANTISSA
TAPE
MANTISSA EQUAL
LOWER MANTISSA
NO
MA
04
YES
MATCH RETURN

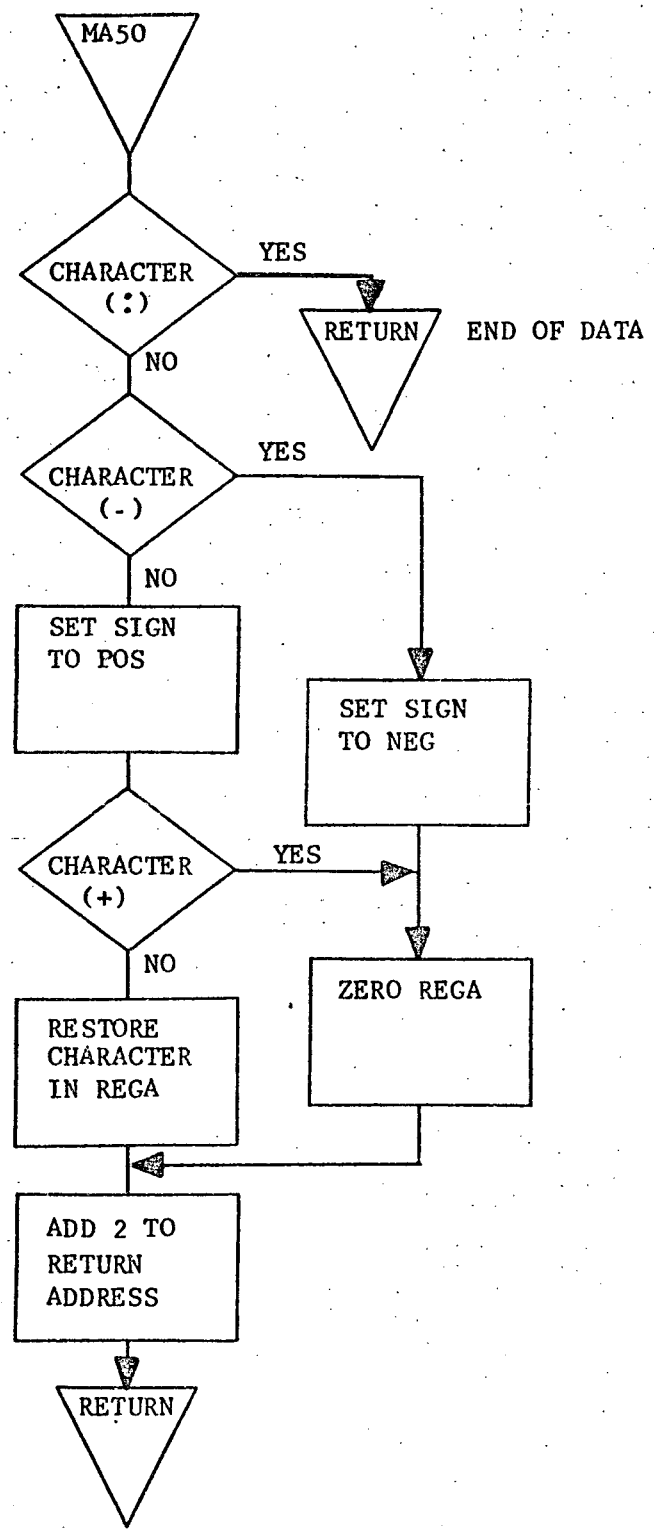

MA
35
ZERO
LEADING
ZERO SW
MAZS
DEC POINT SW
MADS
HIGH COUNT
MAHC
HIGH EXPONENT
MAHE
MAW1
FILL
ZERO HIGH
MANTISSA
LOAD ADDRESS
OF HIGH
EXPONENT IN
MAI4
LOAD ADDRESS
OF HIGH
COUNT IN
MAI3
LOAD ADDRESS
OF HIGH
MANTISSA IN
MABA
LOAD ADDRESS
OF HIGH SIGN
IN MASI
4

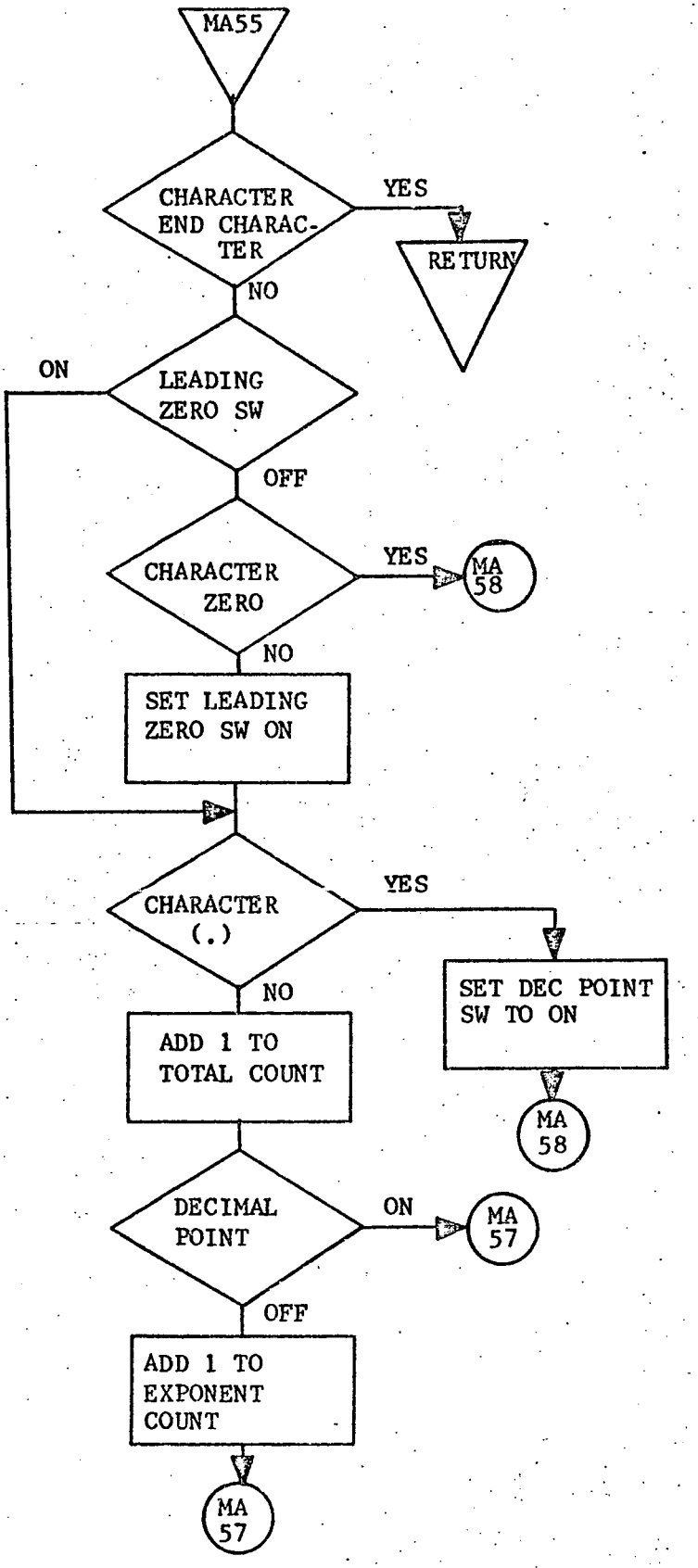

4
PICK ADDRESS OF 2ND REQUEST
UP00
GET 1ST CHARACTER FROM REQUEST
MA50
CHECK SIGN
END OF DATA
YES
MA 04
NO
SIGN PRESENT
YES
MA 37
MA 36
NO
MA55
PACK IT HIGH
END OF DATA
YES
MA 37
NO
MA97
CHECK ODD
UP01
GET NEXT CHARACTER
MA 38
MA 36

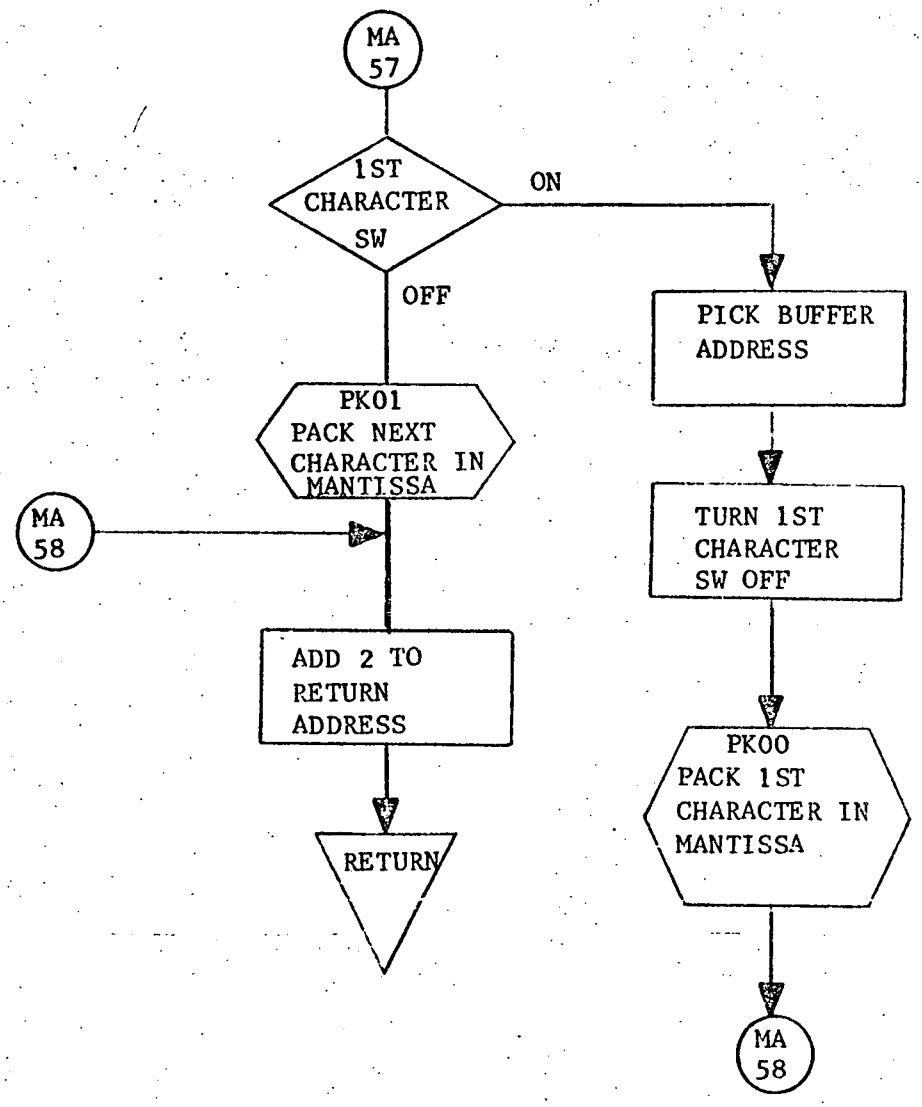

MA 38
TAPE SIGN LOWER SIGN
>
<
=
MA 46
MA 04
TAPE EXPONENT LOWER EXPONENT
MA 45
MA 43
TAPE COUNT LOWER COUNT
≥
TAPE COUNT REGB
LOWER COUNT REGB
COMPUTE NO. OF WORD TO
TAPE MANTISSA LOWER MANTISSA
RETURN
MATCH

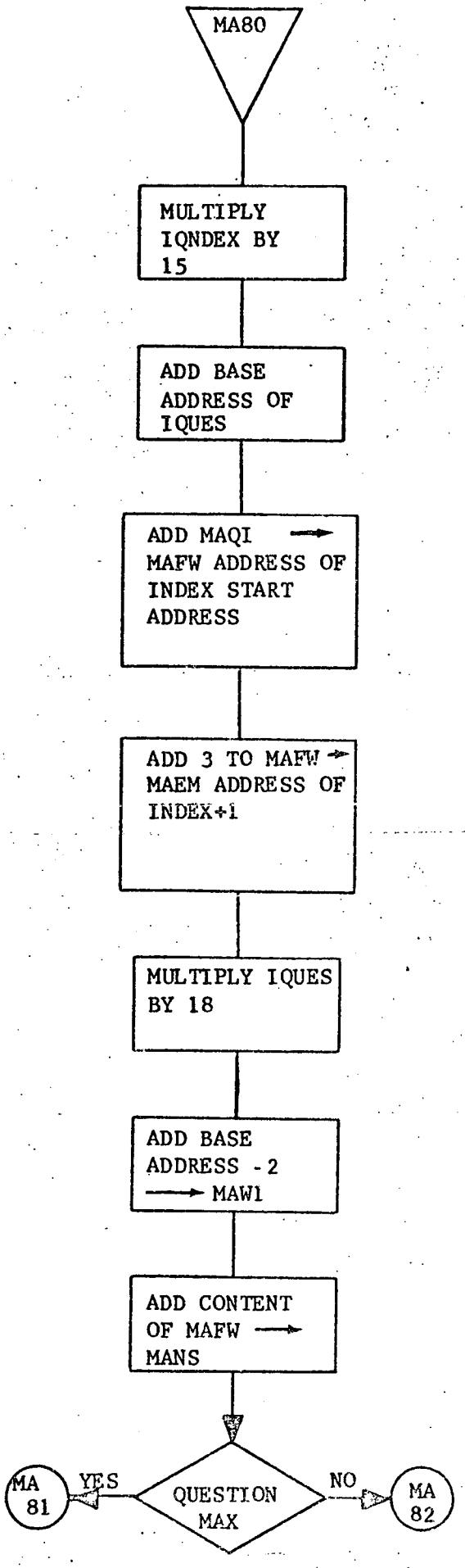

MA 43
TAPE SIGN POS
YES
MA 04
NO MATCH
NO
MA 46
MA 45
TAPE SIGN POS
NO
MA 04
NO MATCH
YES
MA 46
TAPE SIGN HIGH SIGN
NO MATCH
MA 04
>
<
RETURN
MATCH
=
TAPE EXPONENT HIGH EXP.
>
<
MA 64
MA 63
=
MA 48

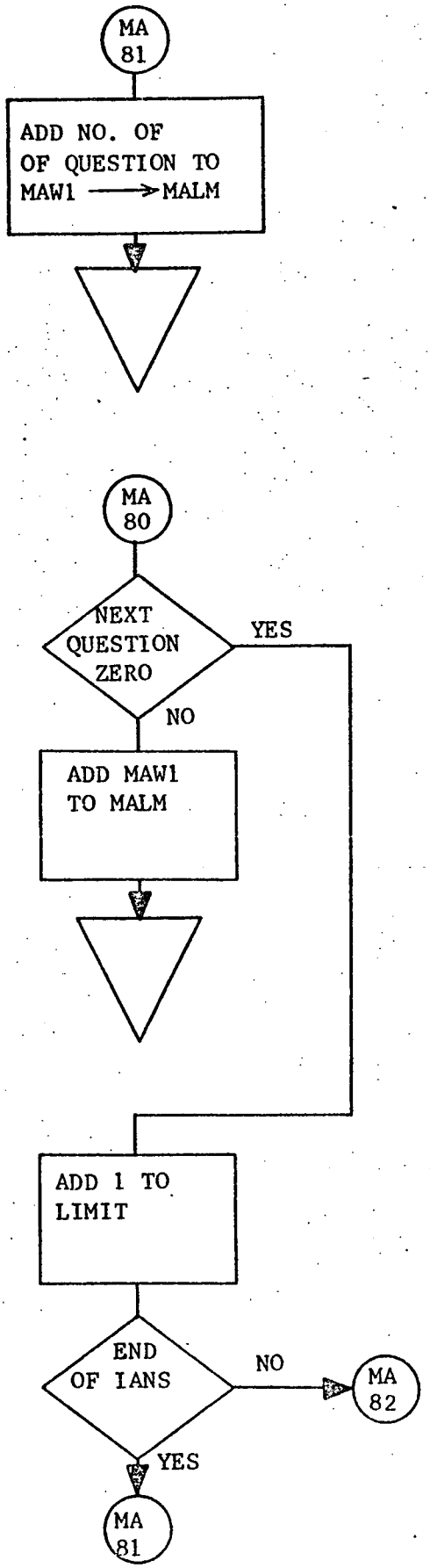

MA 48
TAPE COUNT HIGH COUNT
>
<
TAPE COUNT REGB
HIGH COUNT REGB
COMPUTE NO. WORDS TO COMPARE
TAPE MANTISSA HIGH MANTISSA
>
<
=
MA 64
MA 63
RETURN
MATCH
MA 63
TAPE SIGN POS
NO
MA 04
NO MATCH
YES
MATCH
MA 64
TAPE SIGN POS
YES
MA 04
NO MATCH
NO
MATCH

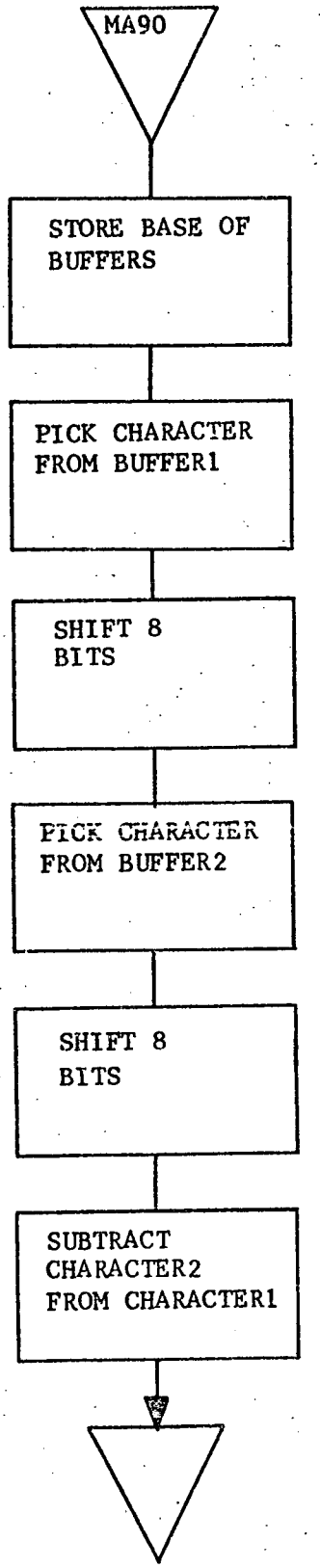

MA50
CHARACTER (:)
YES
RETURN
END OF DATA
NO
CHARACTER (-)
YES
NO
SET SIGN TO POS
SET SIGN TO NEG
CHARACTER (+)
YES
NO
ZERO REGA
RESTORE CHARACTER IN REGA
ADD 2 TO RETURN ADDRESS
RETURN

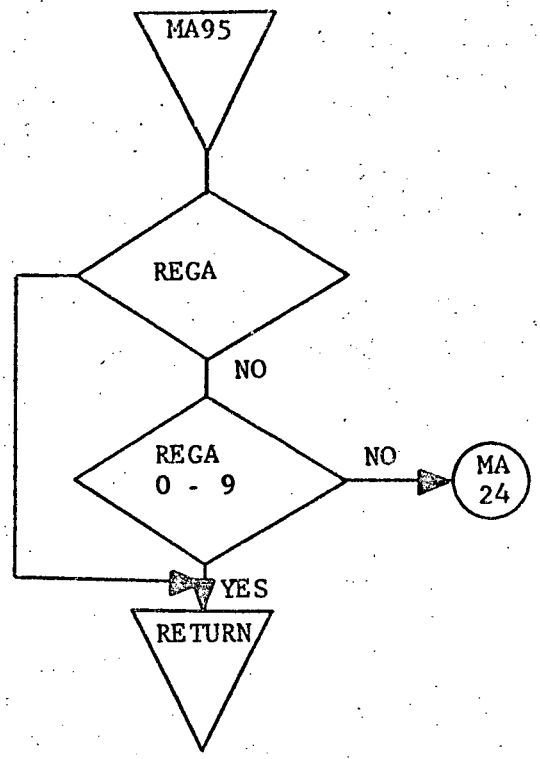

MA55
CHARACTER END CHARAC-TER
YES
RETURN
NO
ON
LEADING ZERO SW
OFF
CHARACTER ZERO
YES
MA 58
NO
SET LEADING ZERO SW ON
CHARACTER (.)
YES
SET DEC POINT SW TO ON
MA 58
NO
ADD 1 TO TOTAL COUNT
DECIMAL POINT
ON
MA 57
OFF
ADD 1 TO EXPONENT COUNT
MA 57

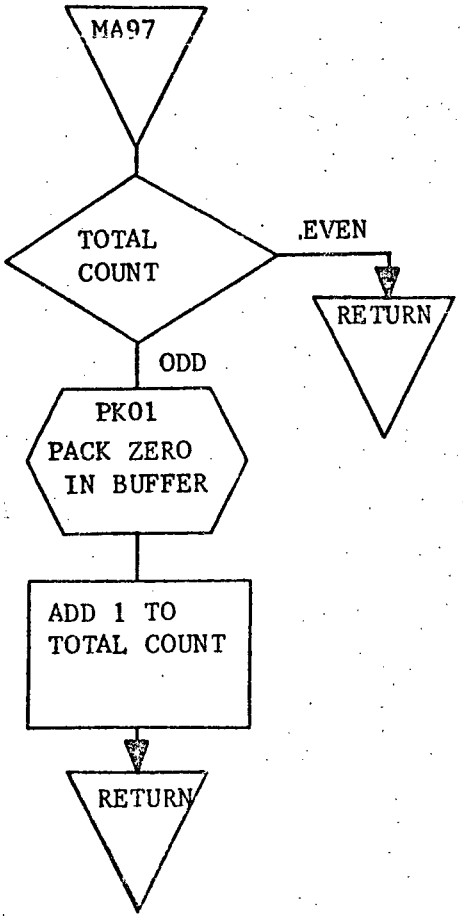

MA
57
1ST
CHARACTER
SW
ON
OFF
PICK BUFFER
ADDRESS
PK01
PACK NEXT
CHARACTER IN
MANTISSA
TURN 1ST
CHARACTER
SW OFF
MA
58
ADD 2 TO
RETURN
ADDRESS
PK00
PACK 1ST
CHARACTER IN
MANTISSA
RETURN
MA
58

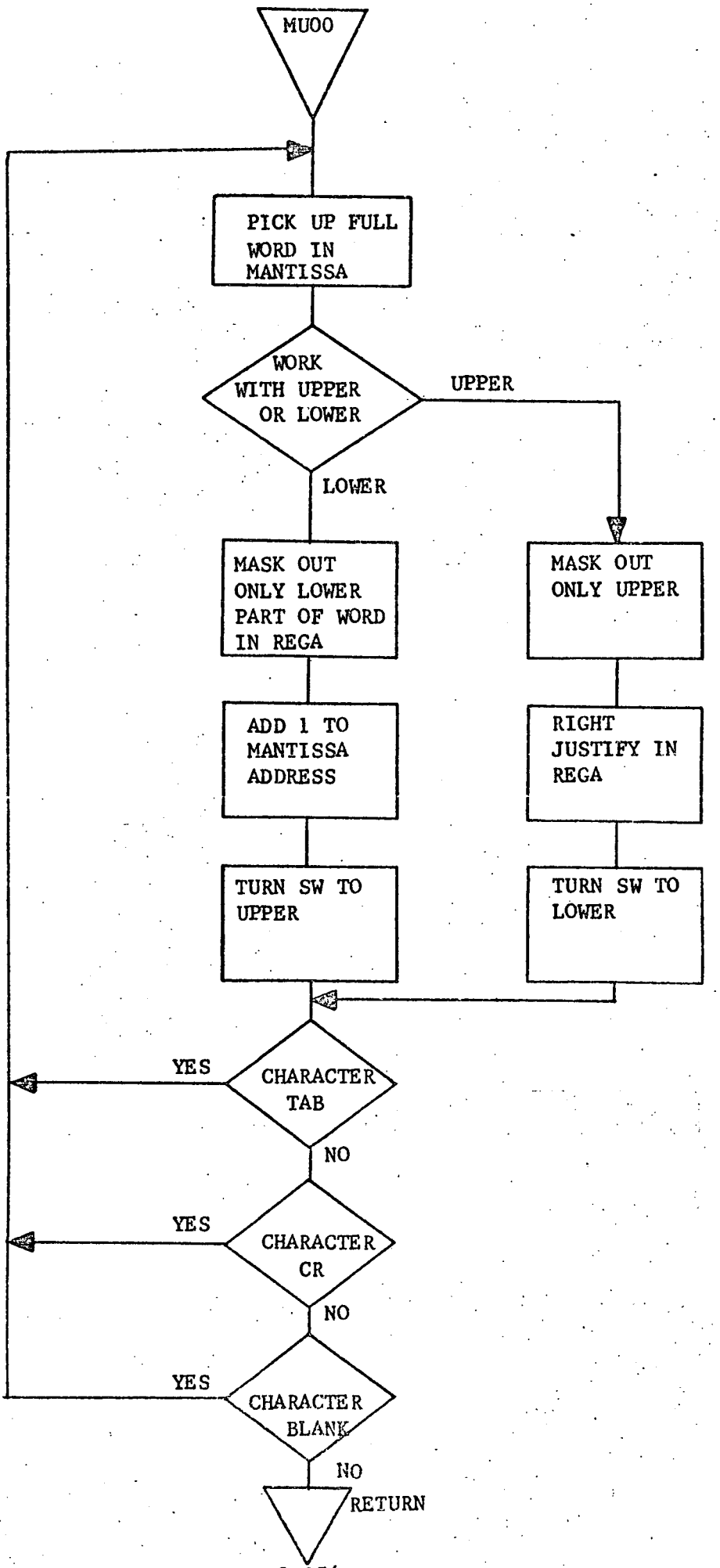

MA80
MULTIPLY IQNDEX BY 15
ADD BASE ADDRESS OF IQUES
ADD MAQI → MAFW ADDRESS OF INDEX START ADDRESS
ADD 3 TO MAFW → MAEM ADDRESS OF INDEX+1
MULTIPLY IQUES BY 18
ADD BASE ADDRESS - 2 → MAW1
ADD CONTENT OF MAFW → MANS
QUESTION MAX
YES
NO
MA 81
MA 82


MA
81
ADD NO. OF
OF QUESTION TO
MAW1 ⟶ MALM
MA
80
NEXT
QUESTION
ZERO
YES
NO
ADD MAW1
TO MALM
ADD 1 TO
LIMIT
END
OF IANS
NO
MA
82
YES
MA
81


MA90
STORE BASE OF BUFFERS
PICK CHARACTER FROM BUFFER1
SHIFT 8 BITS
PICK CHARACTER FROM BUFFER2
SHIFT 8 BITS
SUBTRACT CHARACTER2 FROM CHARACTER1


MA95
REGA
NO
REGA
0 - 9
NO
MA
24
YES
RETURN


MA97
TOTAL
COUNT
.EVEN
RETURN
ODD
PK01
PACK ZERO
IN BUFFER
ADD 1 TO
TOTAL COUNT
RETURN


MUOO
PICK UP FULL WORD IN MANTISSA
WORK WITH UPPER OR LOWER
UPPER
LOWER
MASK OUT ONLY LOWER PART OF WORD IN REGA
MASK OUT ONLY UPPER
ADD 1 TO MANTISSA ADDRESS
RIGHT JUSTIFY IN REGA
TURN SW TO UPPER
TURN SW TO LOWER
YES
CHARACTER TAB
NO
YES
CHARACTER CR
NO
YES
CHARACTER BLANK
NO
RETURN

3.3.18 MC00 - Match Condition

3.3.18.1 Purpose

MC00 is a subroutine whose purpose is to determine if a match exists between a user specified alphanumeric character string which constitutes the condition parameter and an entry on the tape record.

3.3.18.2 Technical Description

The routine initially checks for the default selection (5th word of Request Table equal to zero). If the default option has been selected, a 'MATCH' return is initiated; otherwise, the Bool buffer (CPBB) is cleared and each heading:answer pair on the current master record is then compared to each condition response parameter in the user's response to the question "CONDITION". If no match is found between a master record heading:answer pair and a condition response parameter, a 'NO MATCH' return is initiated. If, however, a match does occur, control is passed to TC00 to determine if the entire condition response parameter string is matched. On finding the Boolean expression true (See Section 3.3.39) control is returned to 'match' return address of the calling program. If TC00 returns a 'no-match' then the next condition response parameter is processed. This procedure is repeated until either TC00 returns a 'match' status or all conditions response parameters have been processed.

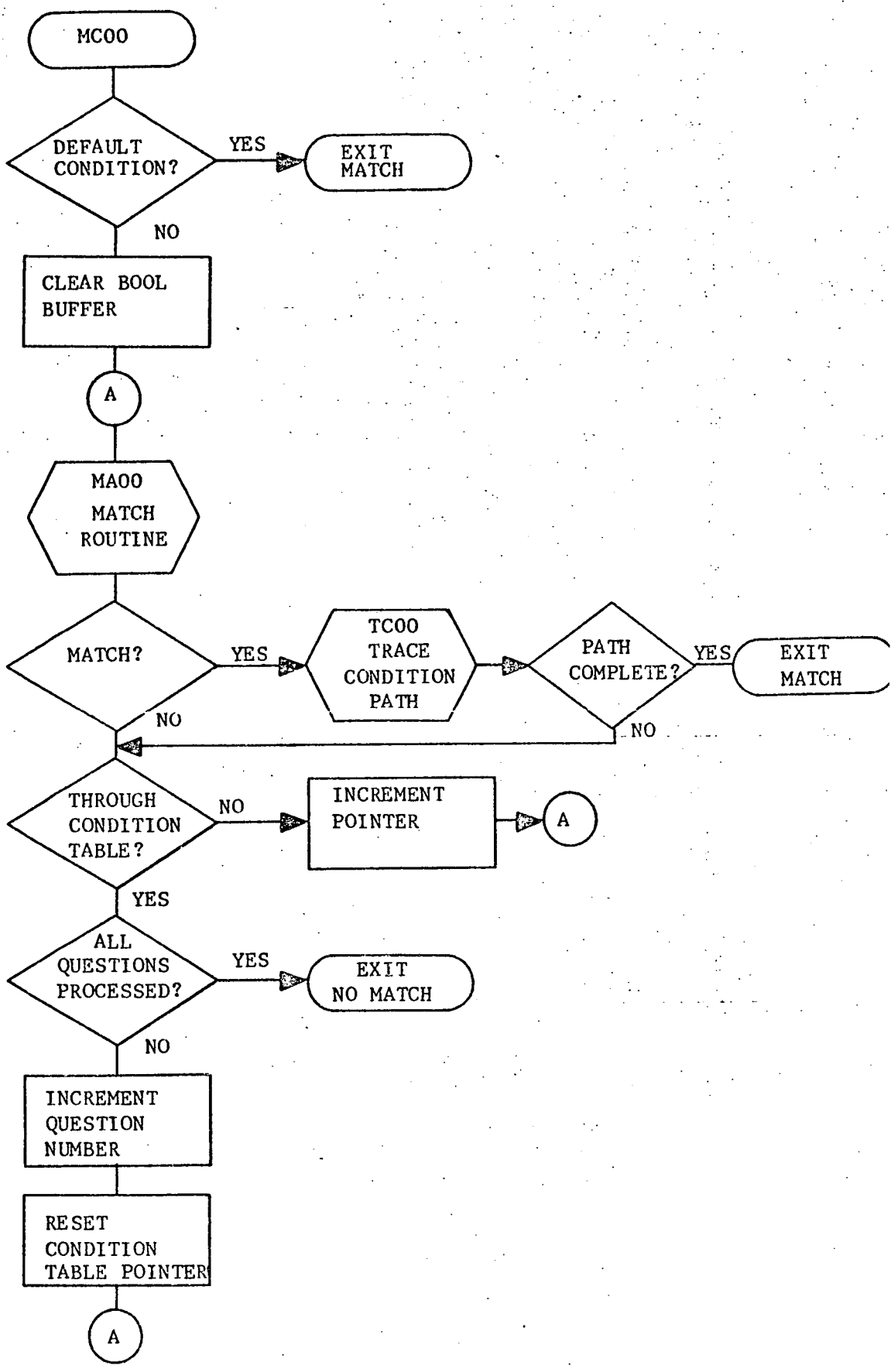
3.3.18.2.1 Calling Sequence

```
CALL   MCOO,A,B
```

PARAMETER	FUNCTION
A	Memory location whose contents specify where to return in the calling program in case of a match.
B	Memory location whose contents specify where to return in the calling program in case of a non-match.

REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	N/A	Unpredictable
B	N/A	Unpredictable
X	N/A	Unpredictable
Overflow	N/A	N/A

3.3.18.2.2 General Flow Chart



3.3.18.3 Label Description

3.3.18.3.1 Local

MCCT - storage location which contains the starting address of the condition table.

MCMT - storage location which contains the address to which this routine returns in case of a match.

MCNM - storage location which contains the address to which this routine returns in case of a non-match.

MCQN - storage location which contains the current tape question number being processed.

MCSA - storage location which contains the pointer to the operand buffer.

3.3.18.3.2 Global

MCSW - storage location which is set to zero each time this routine is referenced.

3.3.18.3.3 Entry Point

MC00 - primary entry point.

3.3.18.3.4 External Reference

3.3.18.3.4.1 External Labels

CPBB - starting address of the Bool buffer.

CPCT - starting address of the condition table.

CPRT - starting address of the request table.

CPTB+2 - storage location which contains the number of questions on the record being processed.

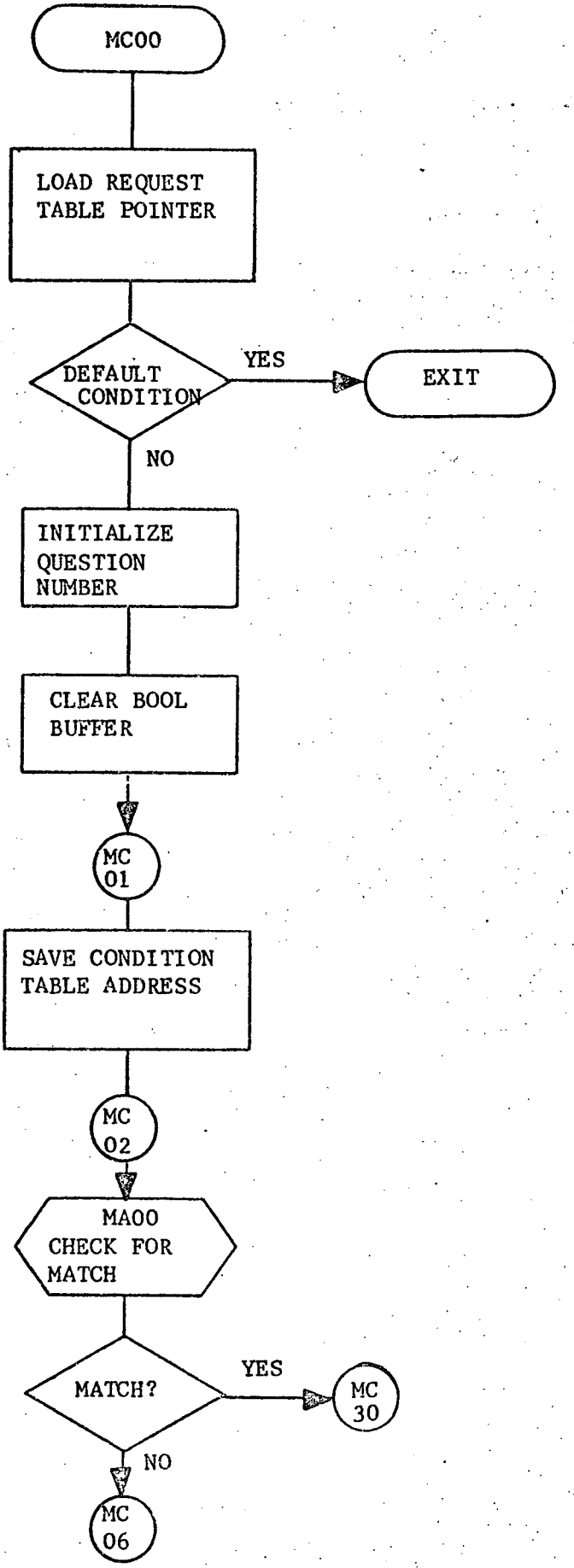
CPXD - storage location which is used as an index into the operand buffer.

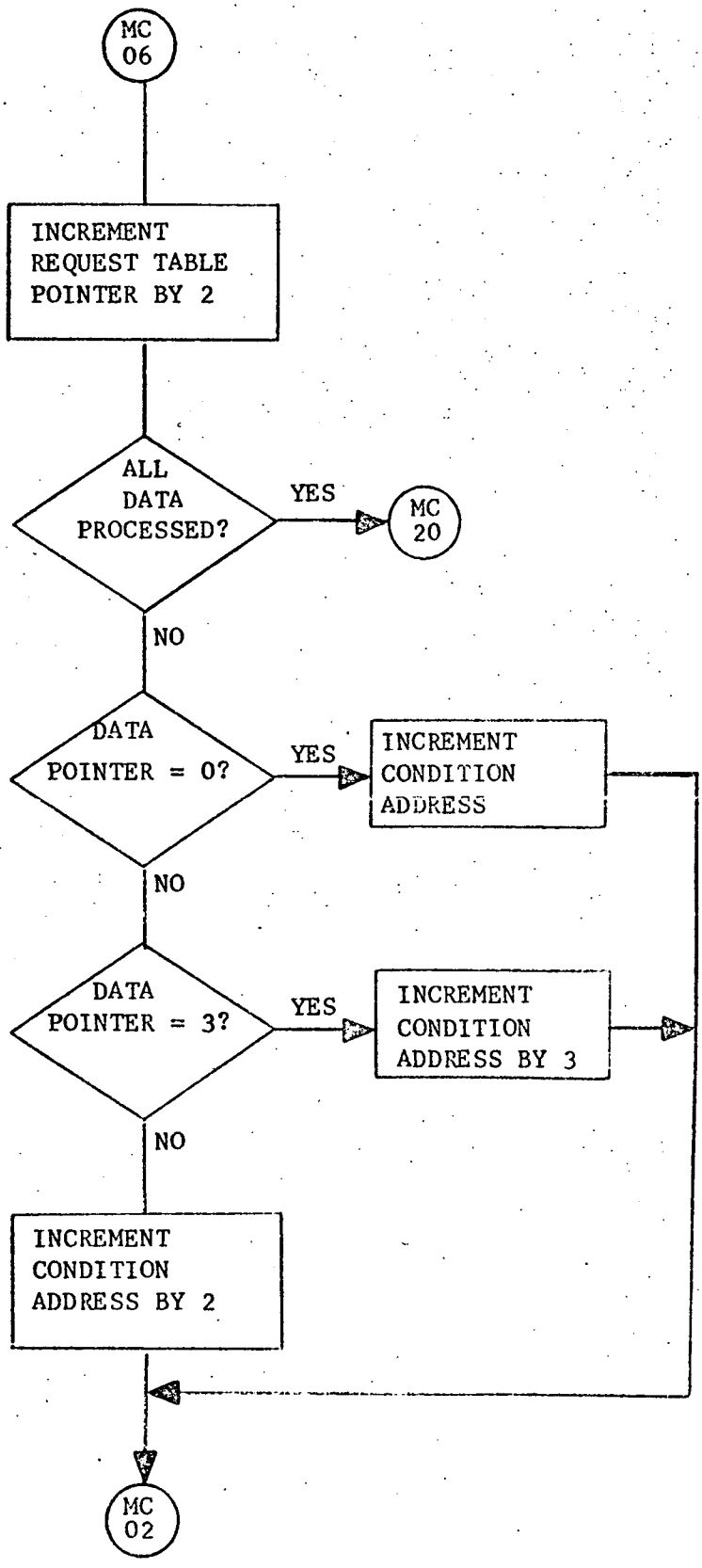
3.3.18.3.4.2 External Subroutines

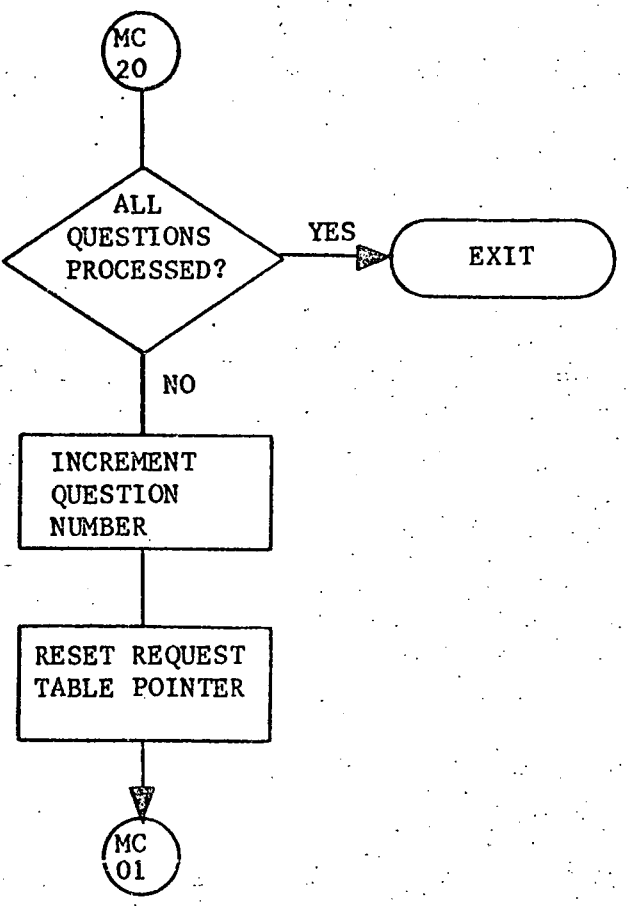
MAOO - match routine

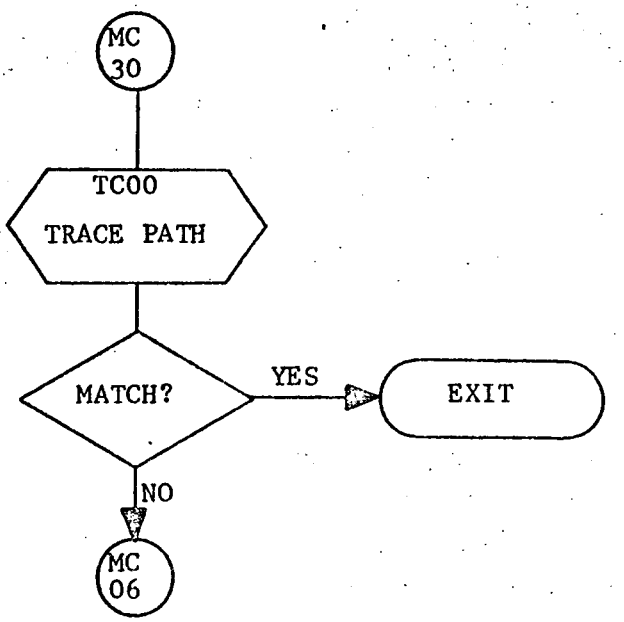
TCOO - trace condition routine

3.3.18.4 Detailed Flow Chart




MC
06
INCREMENT
REQUEST TABLE
POINTER BY 2
ALL
DATA
PROCESSED?
YES
MC
20
NO
DATA
POINTER = 0?
YES
INCREMENT
CONDITION
ADDRESS
NO
DATA
POINTER = 3?
YES
INCREMENT
CONDITION
ADDRESS BY 3
NO
INCREMENT
CONDITION
ADDRESS BY 2
MC
02


MC
20
ALL
QUESTIONS
PROCESSED?
YES
EXIT
NO
INCREMENT
QUESTION
NUMBER
RESET REQUEST
TABLE POINTER
MC
01


MC
30
TC00
TRACE PATH
MATCH?
YES
EXIT
NO
MC
06

3.3.19 MD00 - Match Date

3.3.19.1 Purpose

MD00 is a subroutine whose purpose is to compare the date on the current tape record to the date or range of dates in the user response to the "DATE" question.

3.3.19.2 Technical Description

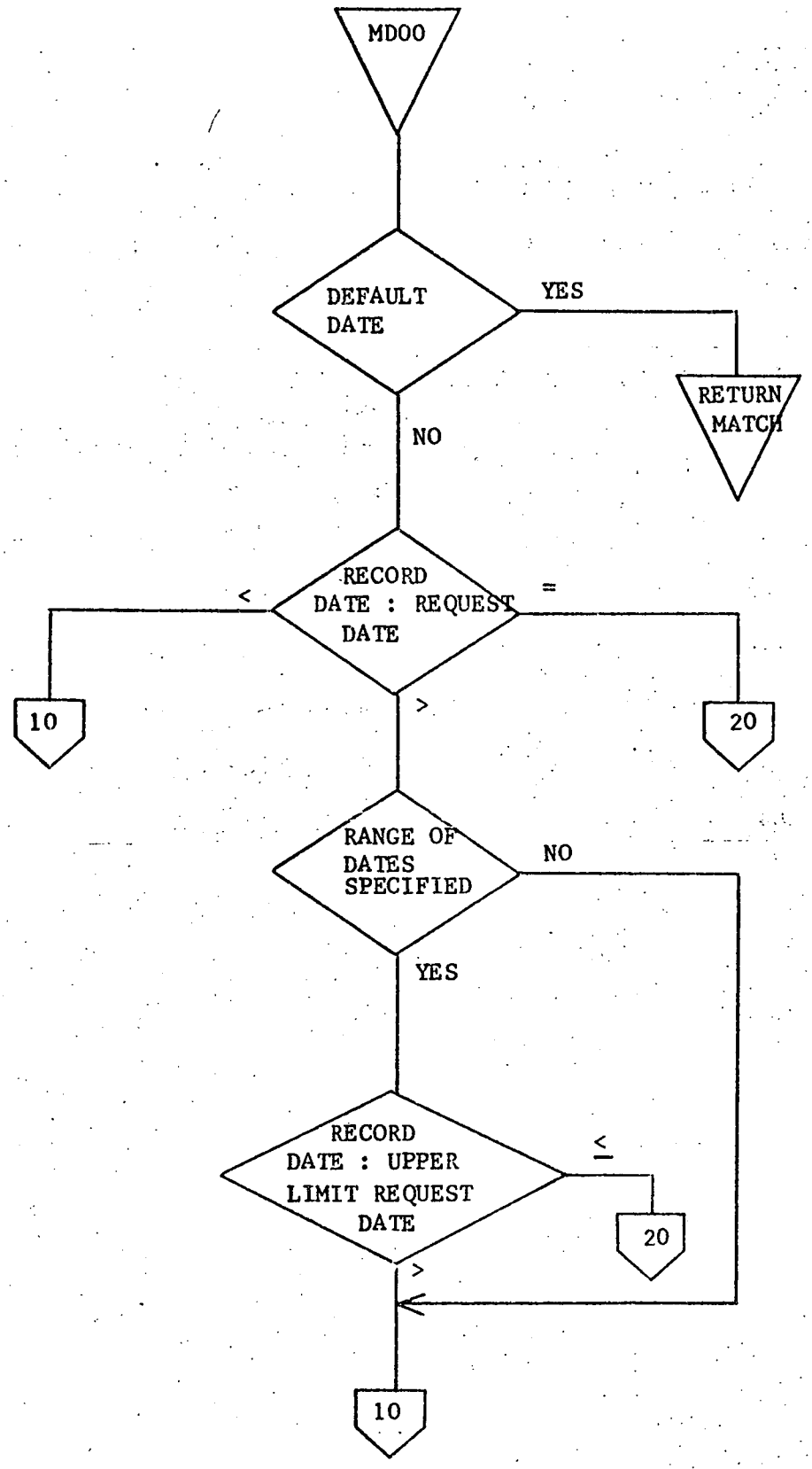
The fourth word of the Request Table contains a pointer to the beginning of the date response in the Request Buffer. If the pointer is zero, implying the default condition, control is passed to the calling program with a match. Otherwise, the date on the current tape record is compared to the user requested date. The user may request a date range (10MAR70-20JUN70), in which case a master record date need only fall within the two values to constitute a match.

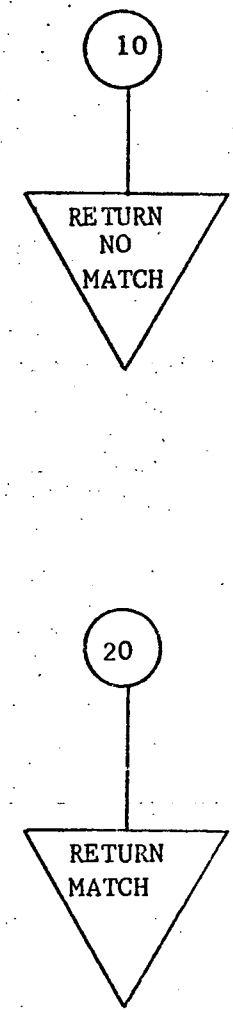
3.3.19.2.1 Calling Sequence

CALL MD00

REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	N/A	Unpredictable
B	N/A	Unpredictable
X	N/A	Unpredictable
Overflow	N/A	N/A

3.3.19.2.2 General Flow Chart




10
RETURN
NO
MATCH
20
RETURN
MATCH

3.3.19.3 Label Description

3.3.19.3.1 Local

MDCT - storage location used as a counter which causes the routine not to have to make an extra year-month match check if a match has already been found previously.

3.3.19.3.2 Global

N/A

3.3.19.3.3 Entry Points

MDOO - primary entry point

3.3.19.3.4 External References

CPRT+3 - date portion of the Request Table

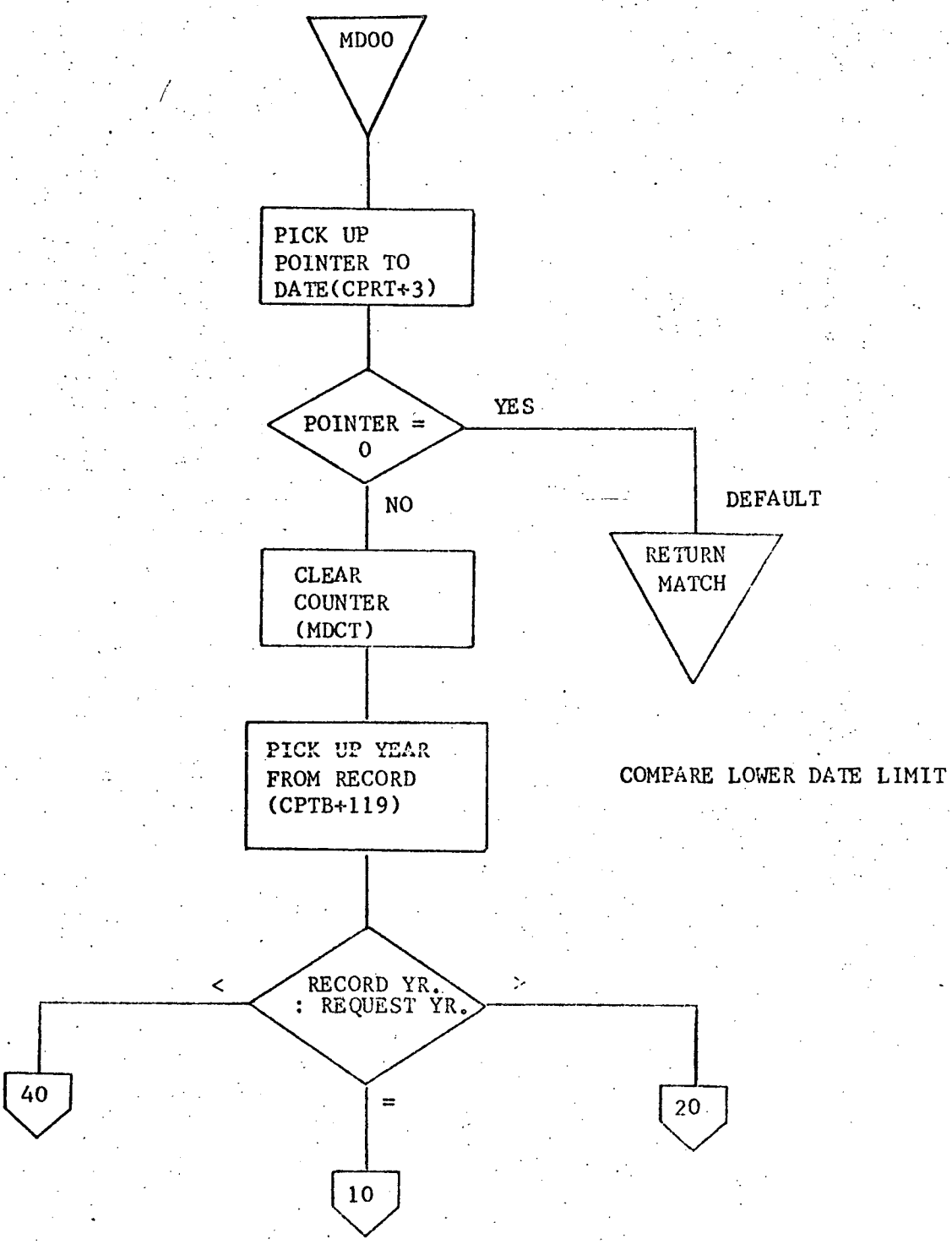
CPTB+119 - that word in the Tape Input Buffer which contains the year part of the tape record date

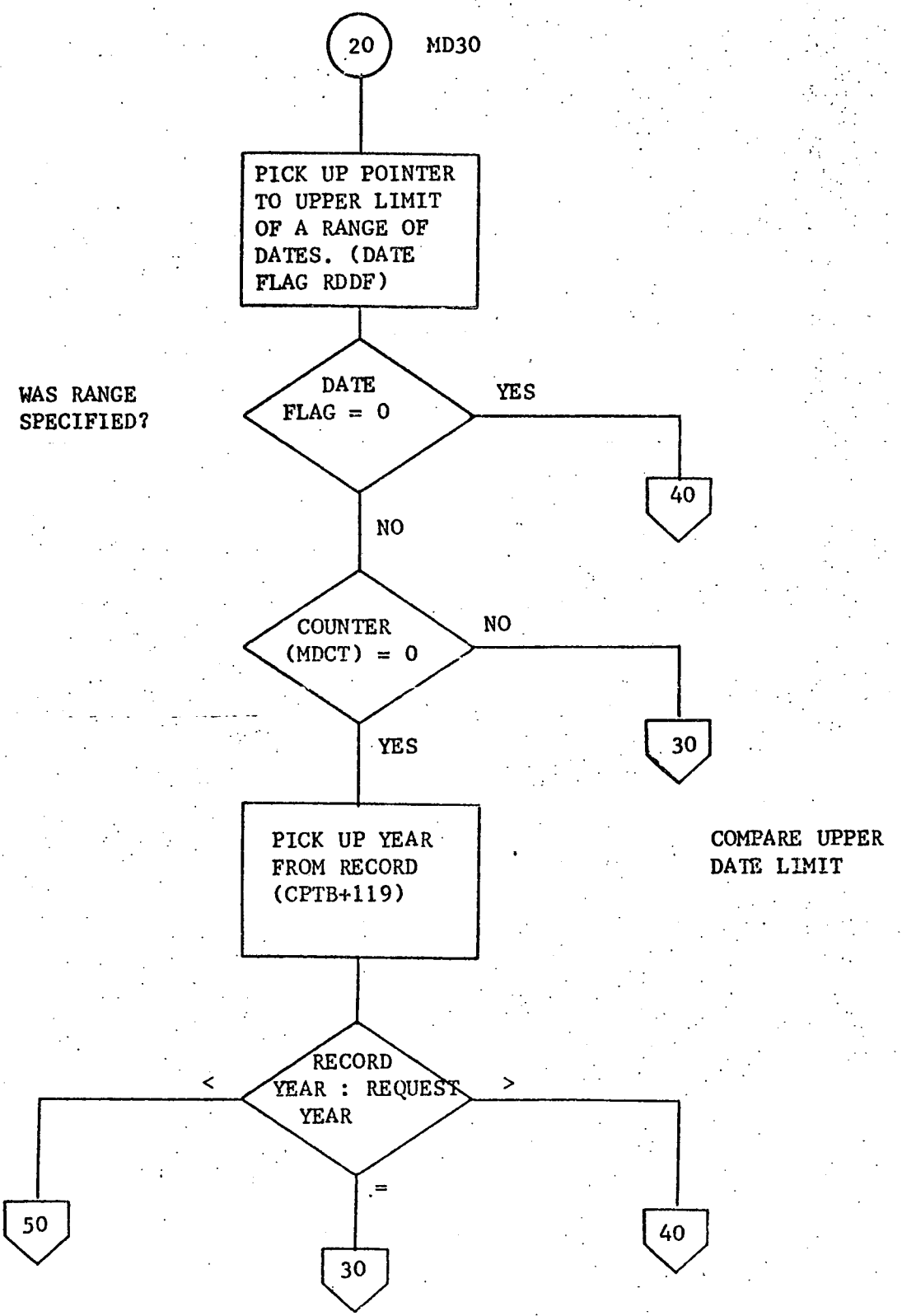
CPTB+122 - that word in the Tape Input Buffer which contains the month part of the tape record date

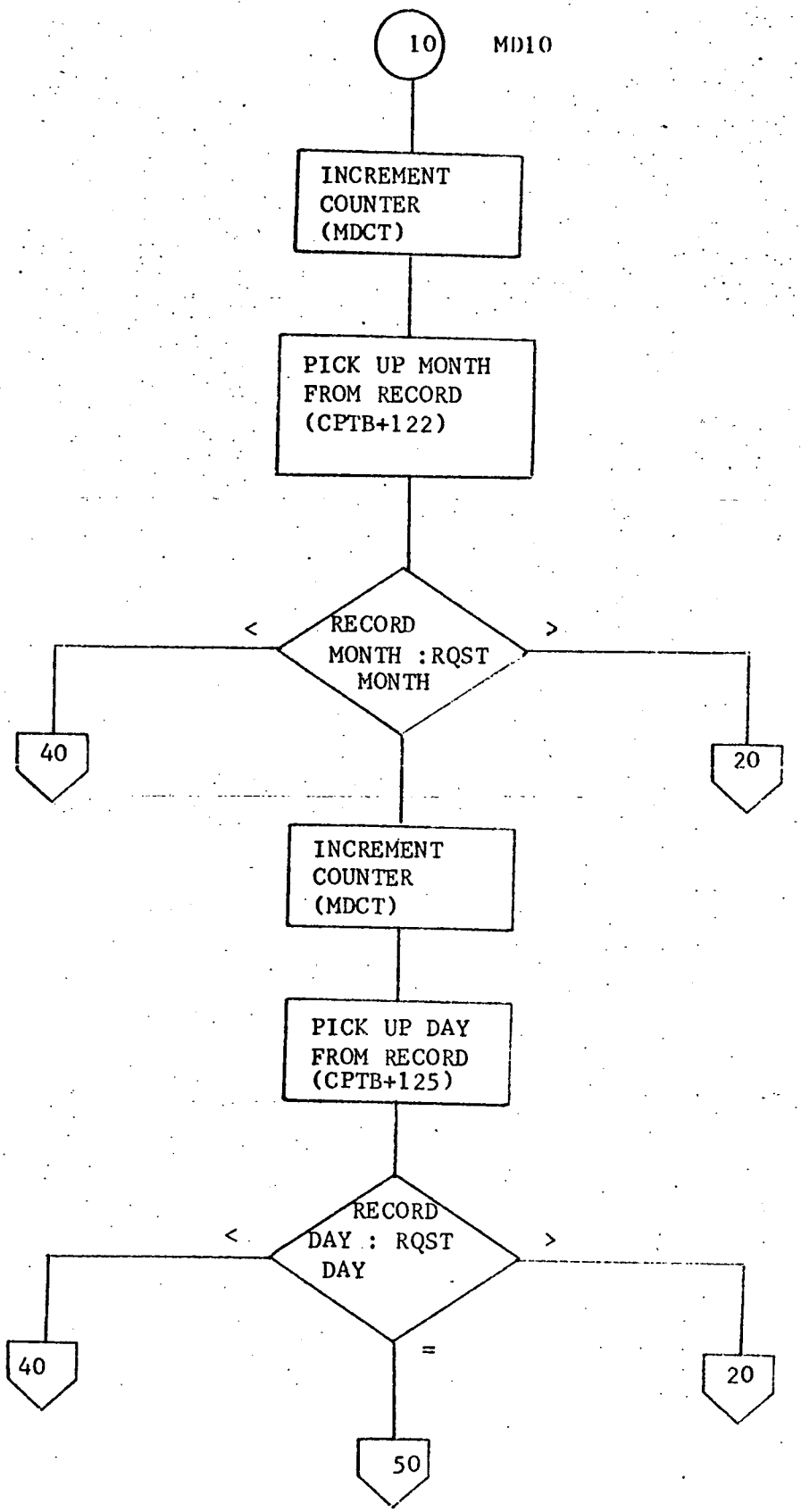
CPTB+125 - that word in the Tape Input Buffer which contains the day part of the tape record date

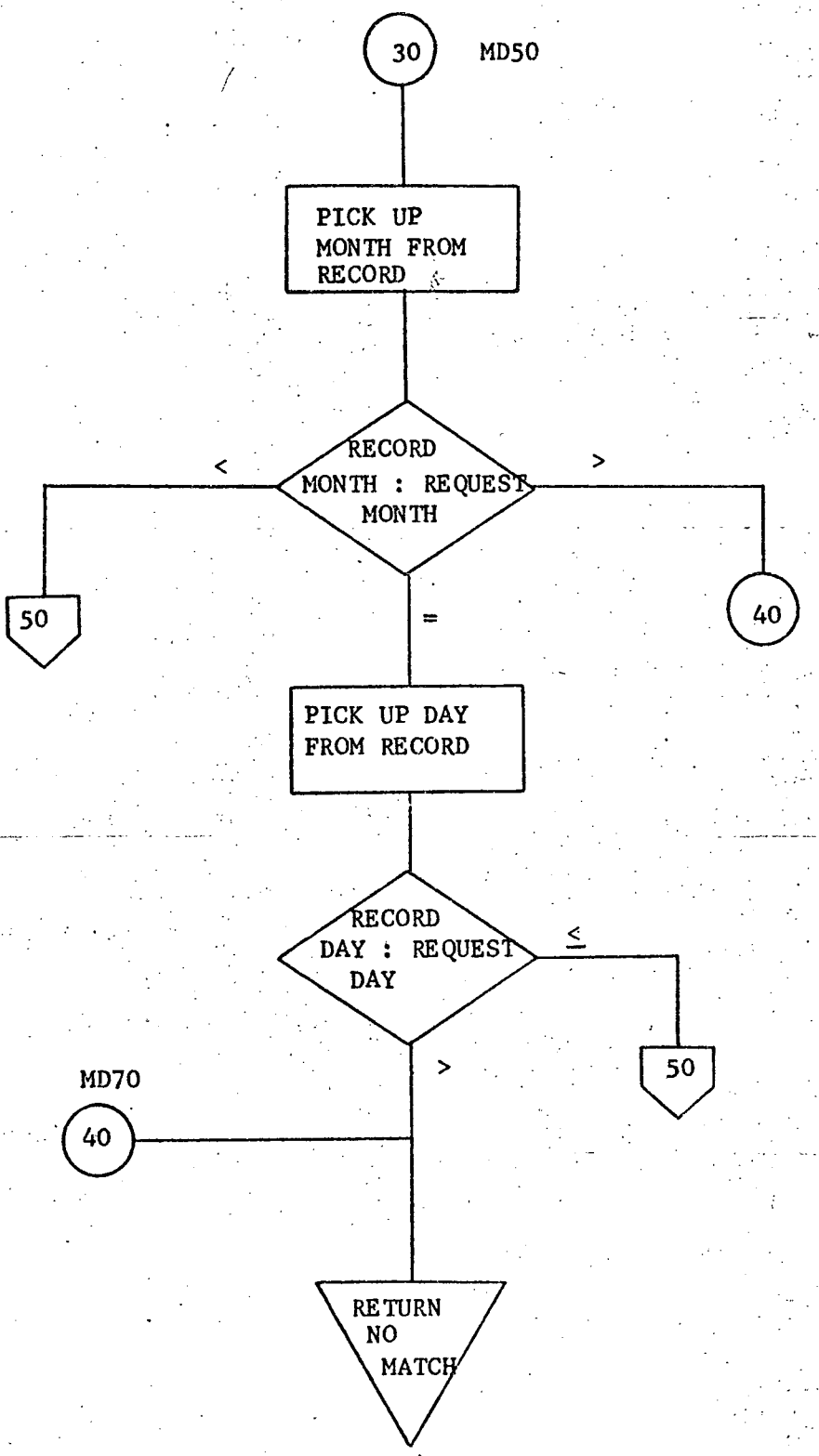
RDDF - flag which is set if a date range has been specified

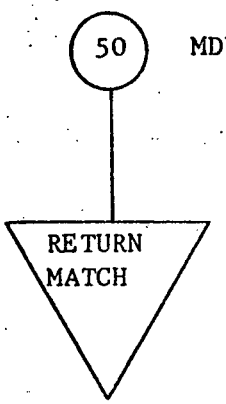
3.3.19.4 Detailed Flow Chart




20
MD30
PICK UP POINTER TO UPPER LIMIT OF A RANGE OF DATES. (DATE FLAG RDDF)
WAS RANGE SPECIFIED?
DATE FLAG = 0
YES
40
NO
COUNTER (MDCT) = 0
NO
30
YES
PICK UP YEAR FROM RECORD (CPTB+119)
COMPARE UPPER DATE LIMIT
RECORD YEAR : REQUEST YEAR
<
>
=
50
30
40


10
MD10
INCREMENT COUNTER (MDCT)
PICK UP MONTH FROM RECORD (CPTB+122)
RECORD MONTH : RQST MONTH
<
>
40
20
INCREMENT COUNTER (MDCT)
PICK UP DAY FROM RECORD (CPTB+125)
RECORD DAY : RQST DAY
<
>
=
40
20
50


30
MD50
PICK UP MONTH FROM RECORD
RECORD MONTH : REQUEST MONTH
<
>
=
50
40
PICK UP DAY FROM RECORD
RECORD DAY : REQUEST DAY
≤
>
50
MD70
40
RETURN NO MATCH


50
MD75
RETURN
MATCH

3.3.20 MW00 - Match What

3.3.20.1 Purpose

MW00 is a subroutine whose purpose is to determine if a match exists between a user specified WHAT response and an entry on the current tape record.

3.3.20.2 Technical Description

The routine initially checks for the default selection (7th word of Request Table equal to zero). If this selection has been made, a 'match' return is initiated; otherwise, the WHAT Table parameters are successively compared to a current tape record heading-andwer pair until either a match is found or all WHAT parameters in the user response to the question "WHAT" have been exhausted.

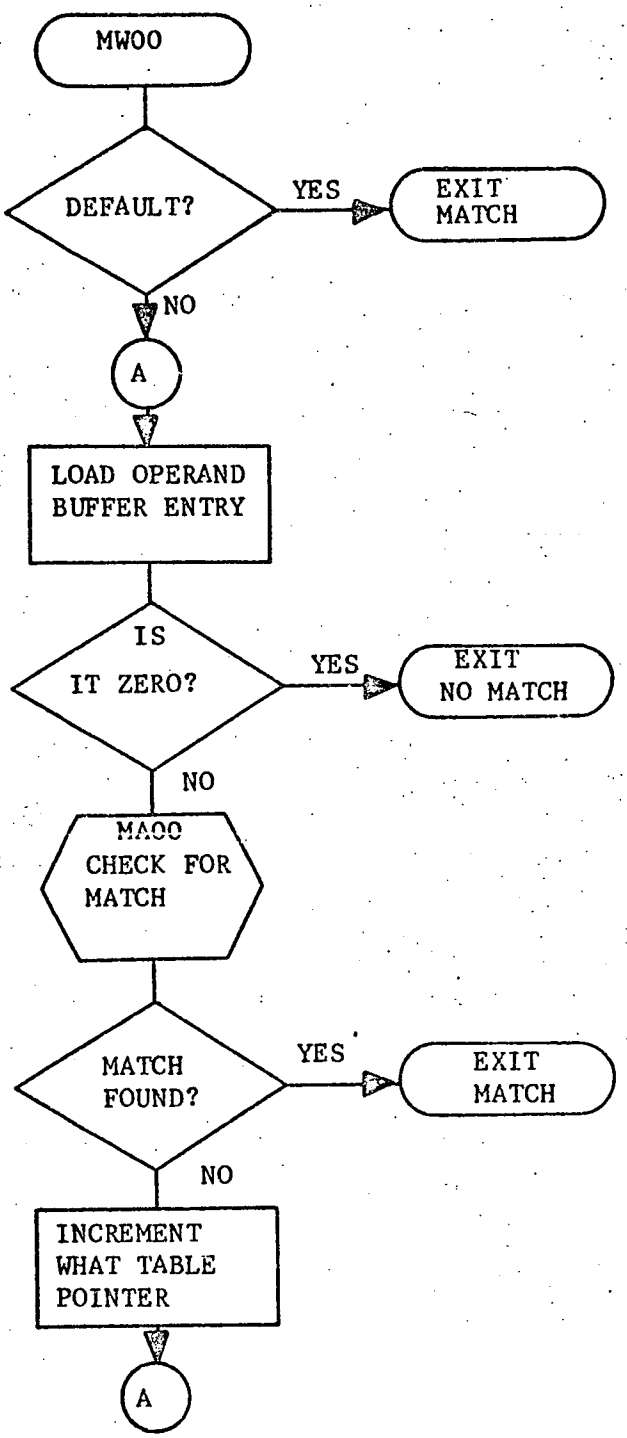
3.3.20.2.1 Calling Sequence

CALL MW00,A,B,C

PARAMETER	FUNCTION
A	Memory location whose contents specify which master file question is being referenced.
B	Memory location whose contents specify where to return in the calling program in case of a match.
C	Memory location whose contents specify where to return in the calling program in case of a non-match.

REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	N/A	Unpredictable
B	N/A	Unpredictable
X	N/A	Unpredictable
Overflow	N/A	N/A

3.3.20.2.2 General Flow Chart



3.3.20.3 Label Description

3.3.20.3.1 Local

MWMT - storage location which contains the return address in case of a match.

MWNM - storage location which contains the return address in case of a non-match.

MWQN - storage location which contains the current tape question number being processed.

MWSA - storage location which contains the pointer to the operand buffer.

MWXP - storage location which contains the beginning address of the WHAT TABLE.

3.3.20.3.2 Global

MWFG - storage location which contains the number of the current tape question being processed.

MWSW - storage location which is set to zero each time this routine is referenced.

3.3.20.3.3 Entry Point

MW00 - primary entry point

3.3.20.3.4 External References

3.3.20.3.4.1 External Labels

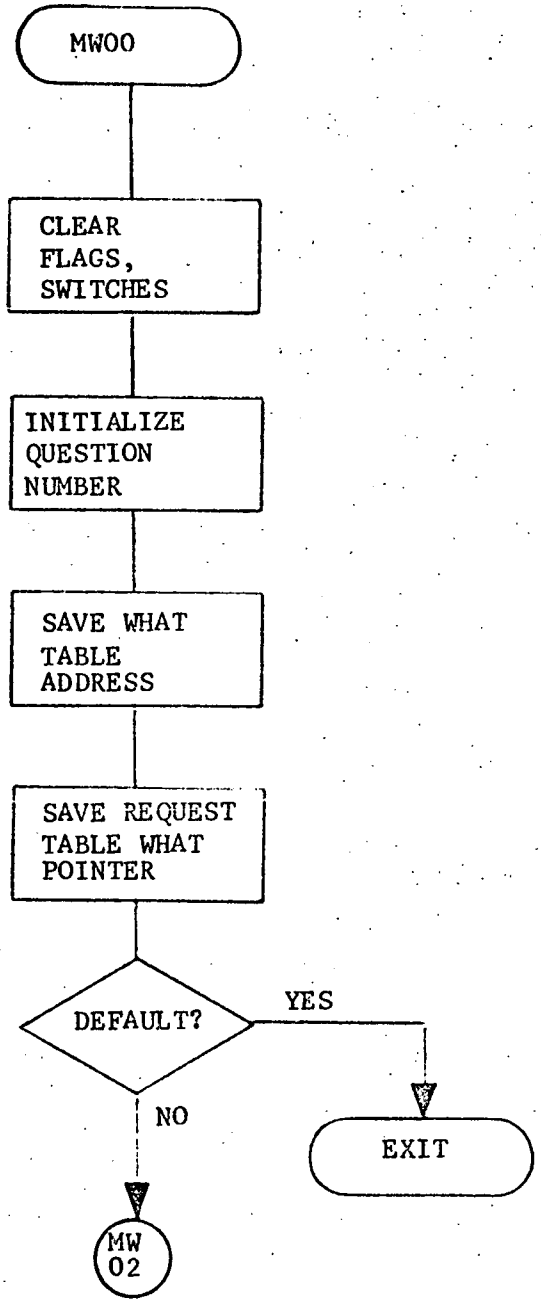
CPRT+6 - storage location which contains either a zero (default condition) or a value pointing to the operand buffer.

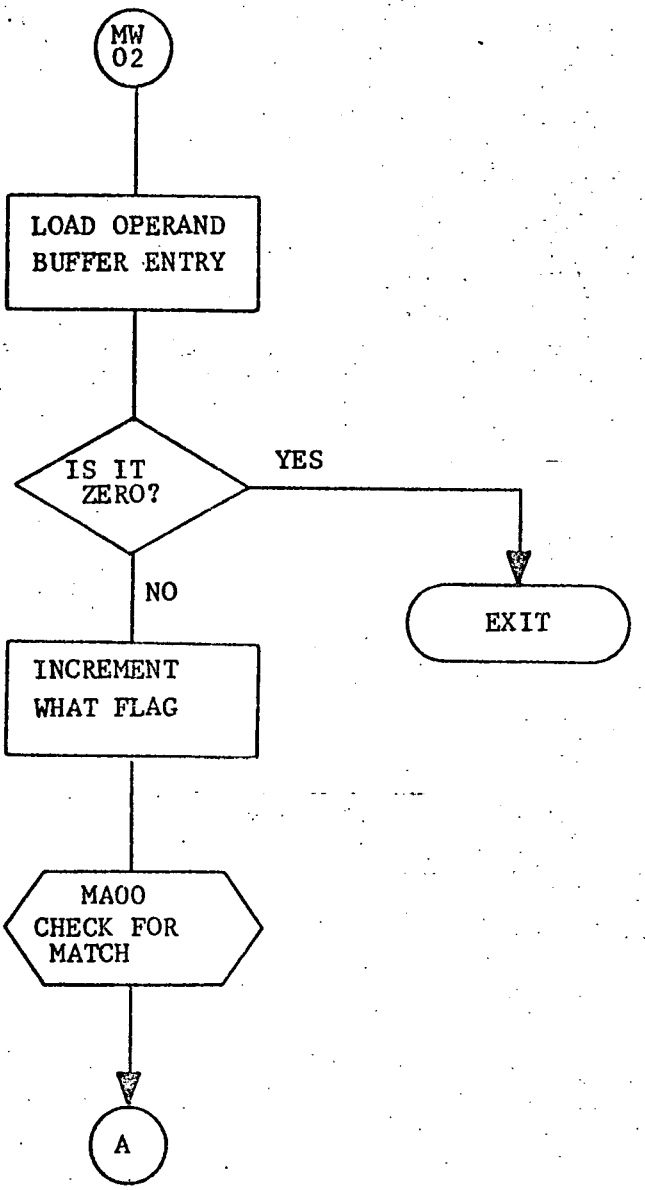
CPWT - beginning address of the WHAT table.

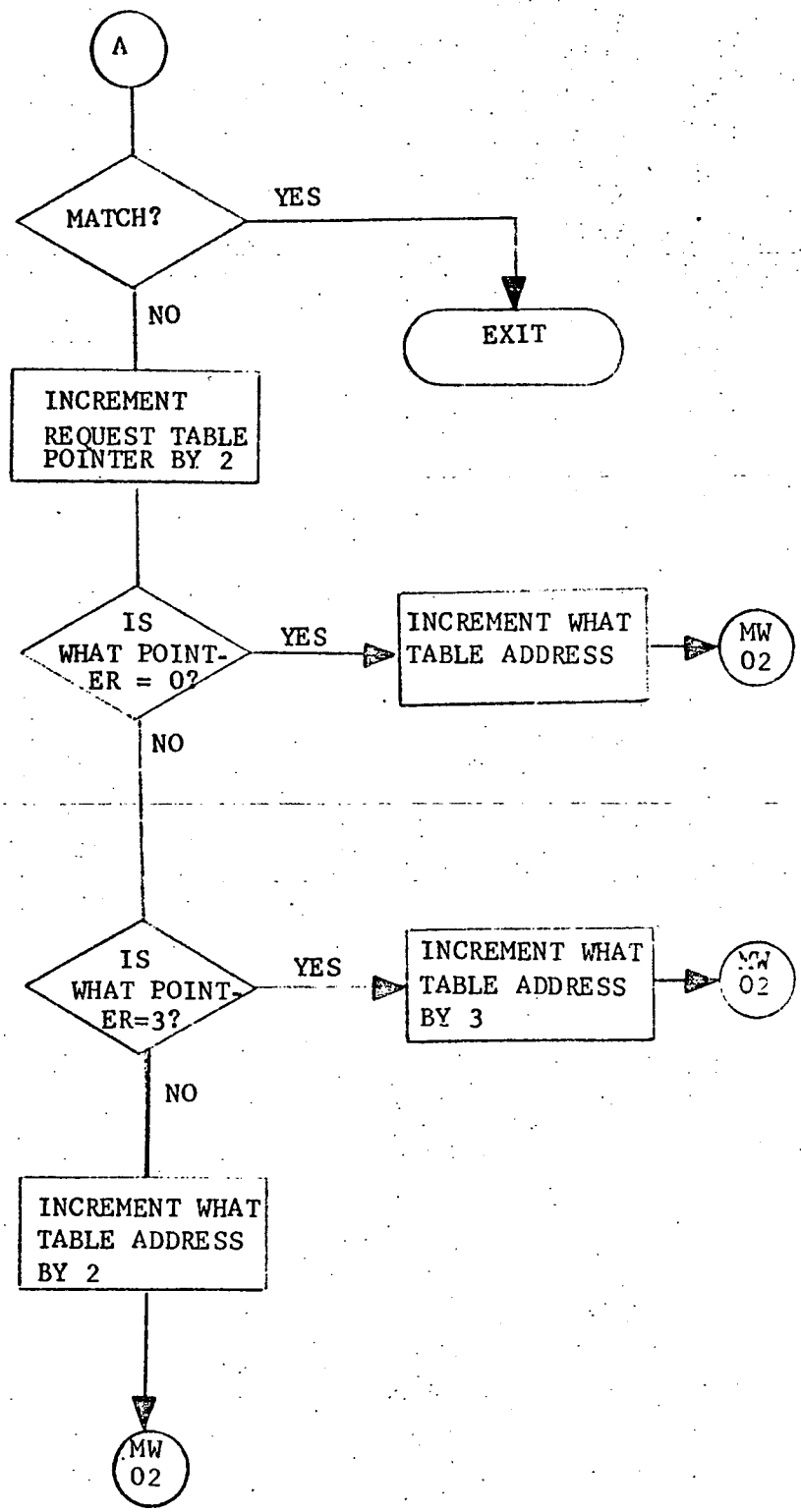
3.3.20.3.4.2 External Subroutines

MA00 - match routine

3.3.20.4 Detailed Flow Chart




MW
02
LOAD OPERAND
BUFFER ENTRY
IS IT
ZERO?
YES
NO
EXIT
INCREMENT
WHAT FLAG
MA00
CHECK FOR
MATCH
A


A
MATCH?
YES
EXIT
NO
INCREMENT REQUEST TABLE POINTER BY 2
IS WHAT POINT-ER = 0?
YES
INCREMENT WHAT TABLE ADDRESS
MW 02
NO
IS WHAT POINT-ER=3?
YES
INCREMENT WHAT TABLE ADDRESS BY 3
MW 02
NO
INCREMENT WHAT TABLE ADDRESS BY 2
MW 02

3.3.21 OM00 - Output Message

3.3.21.1 Purpose

The purpose of the Output Message Routine is to provide MDTRS wiht a generalized output routine which will service all output message requests regardless of the specific hardware configuration in which MDTRS is operating.

3.3.21.2 Technical Description

OM00 is designed to require a common calling sequence for output message requests. OM00 serves as an interface (or link) to the specific I/O handler which has been assigned by the Initialize System (IS00) routine. The common arguments passed to OM00 by the calling program are converted by OM00 to the proper calling sequence required by the specific I/O handlers.

OM00 utilizes a table (OMDT) which contains the addresses of 'set-up' processing to be done for each particular I/O handler. The device code (OMDC) is used to index into the OMDT table to obtain the 'set-up' processing address. After the appropriate handler has been called, OM00 does not regain control until the output character count has been satisfied; however, the assigned I/O handler may return control directly to the calling program for concurrent processing while I/O is taking place. See the individual I/O handler documentation for specific output processing. The operation status word is initialized by the I/O handler to a (-1) as soon as the first character is output. Refer to the calling sequence for additional status codes to be implemented at a later date. When the output is complete

(i.e., the number of characters to be output is satisfied), the operation status word defined by the calling program is changed to a positive value indicating the number of data characters output. If a cancel request has been received during output of the buffer, OM00 will return control to the control program at CP20 in order for a new request to be initiated at the terminal.

3.3.21.2.1 Calling Sequence

CALL OM00,A,B,C,D

PARAMETER	FUNCTION
A	The beginning address where the message is stored. (Packed two characters per word.)
B	The address of a word containing the number of characters to be sent.
C	Always zero (0).
D	The address of an operation status word.

The status returned by the output message routine will be as follows:

Positive value = output complete. The value will be the number of characters transmitted. (May be zero if no data characters are transmitted but operation is complete.)

-1 = output initiated (first character started out)

-2 = parity error (CRT only)

-3 = 103 modem disconnected (TTY output only)

-4 = CRT not ready (CRT only)

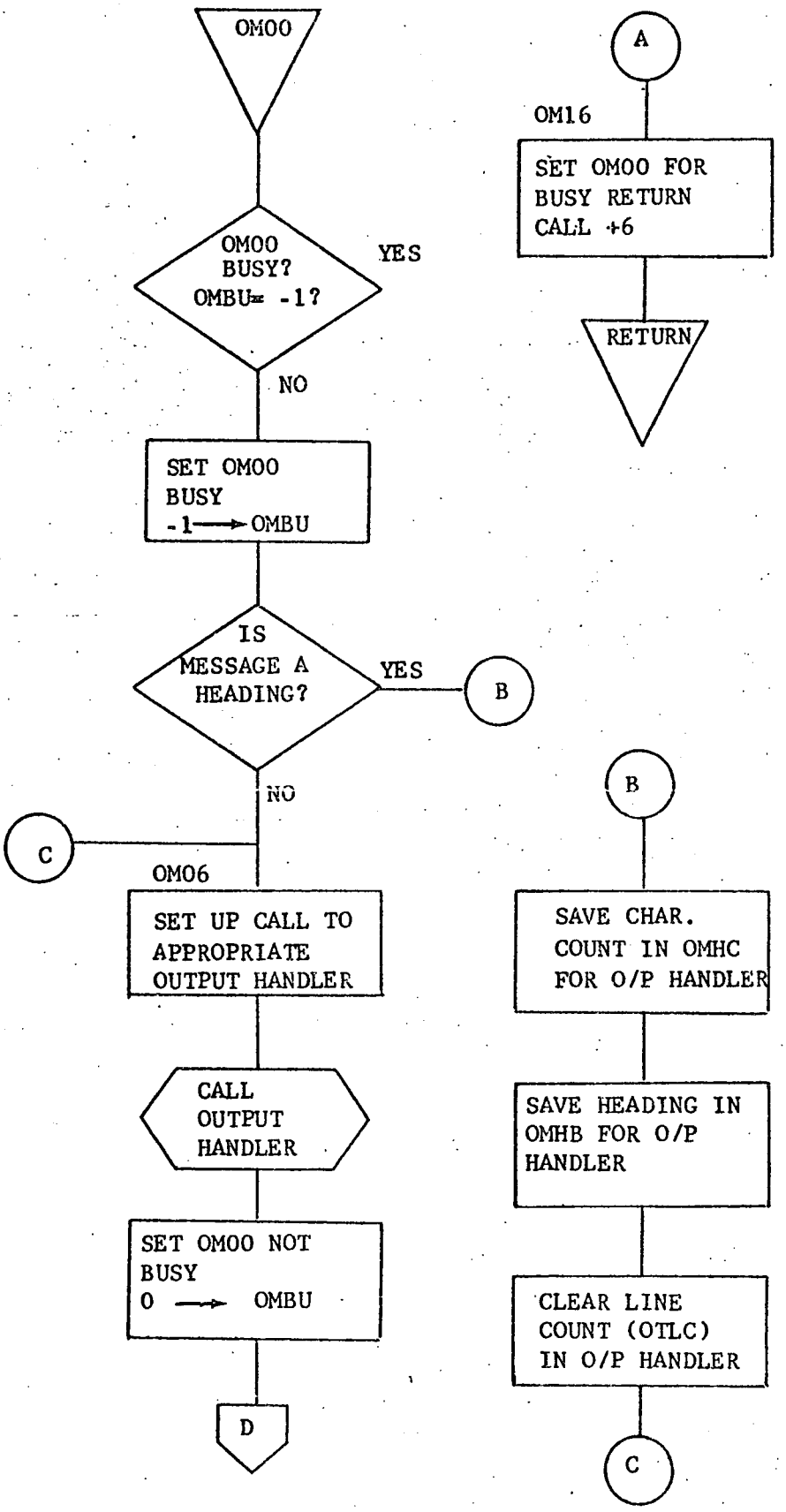
Return addresses will be as follows:

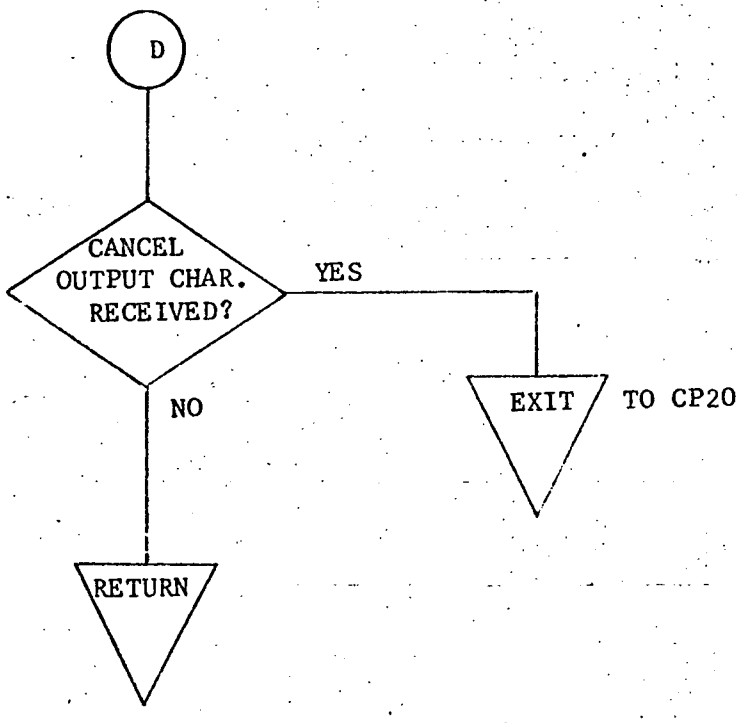
Call +6 = previous I/O request in progress.

Call +8 = normal return. I/O initiated. User must check status word at this point.

REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	Saved	Restored
B	Saved	Restored
X	Saved	Restored
Overflow	Unknown	Modified

3.3.21.2.2 General Flow Chart




D
CANCEL OUTPUT CHAR. RECEIVED?
YES
NO
EXIT
TO CP20
RETURN

3.3.21.3 Label Description

3.3.21.3.1 Local

OMBA Beginning address of Output Buffer (Referenced by O/P handler)

OMCC Address of Output Character Count (Referenced by O/P handler)

OMCP Address of Cursor Position Word if required (Referenced by O/P handler)

OMDC Device code. Set by IS00. (Referenced by O/P handler)

OMHB Heading Buffer (Referenced by O/P handler)

OMHC Heading Character Count (Referenced by O/P handler)

OMOS Address of Operation Status Word (Referenced by O/P handler)

3.3.21.3.2 Global

None

3.3.21.3.3 Entry Points

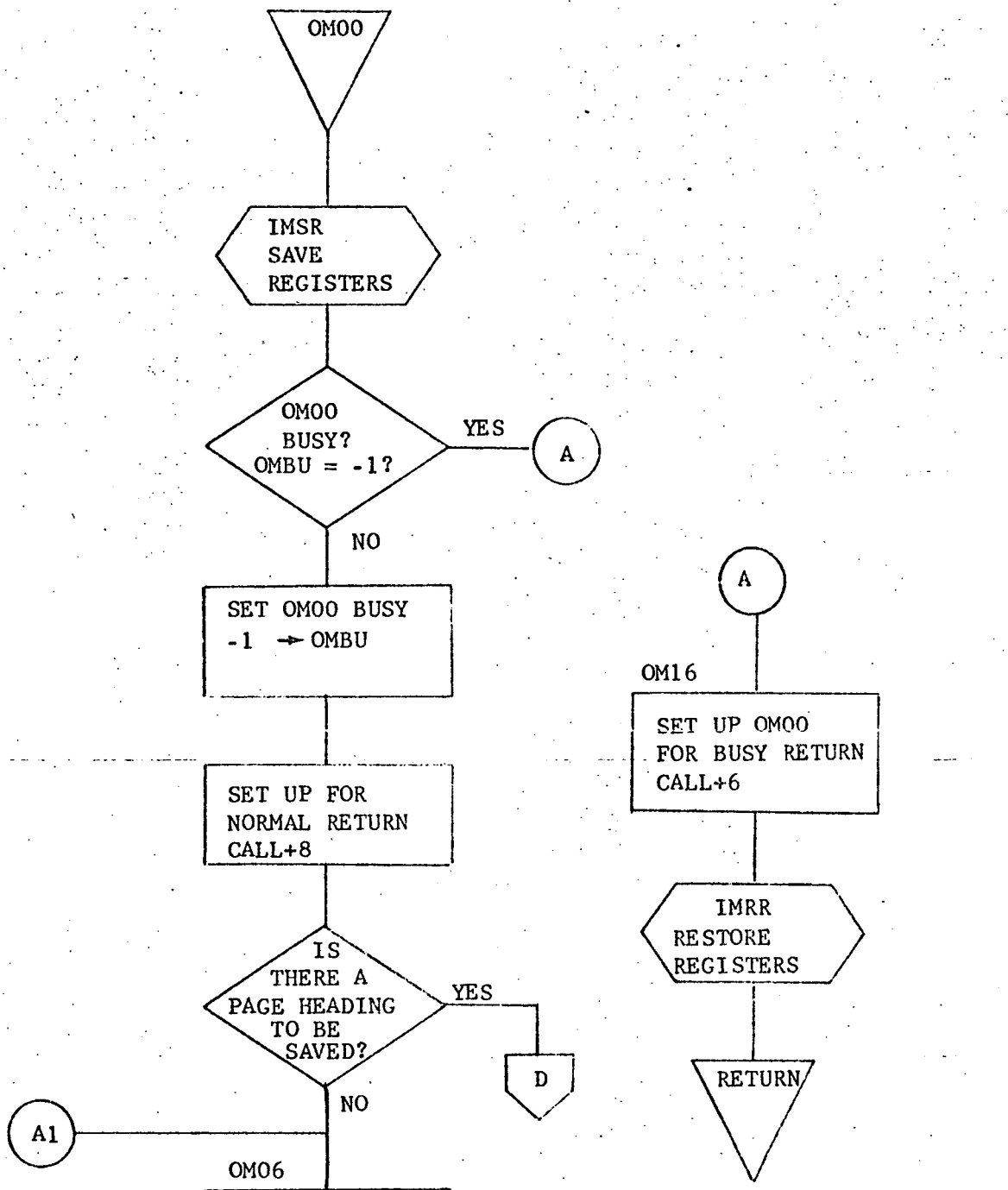
OM00

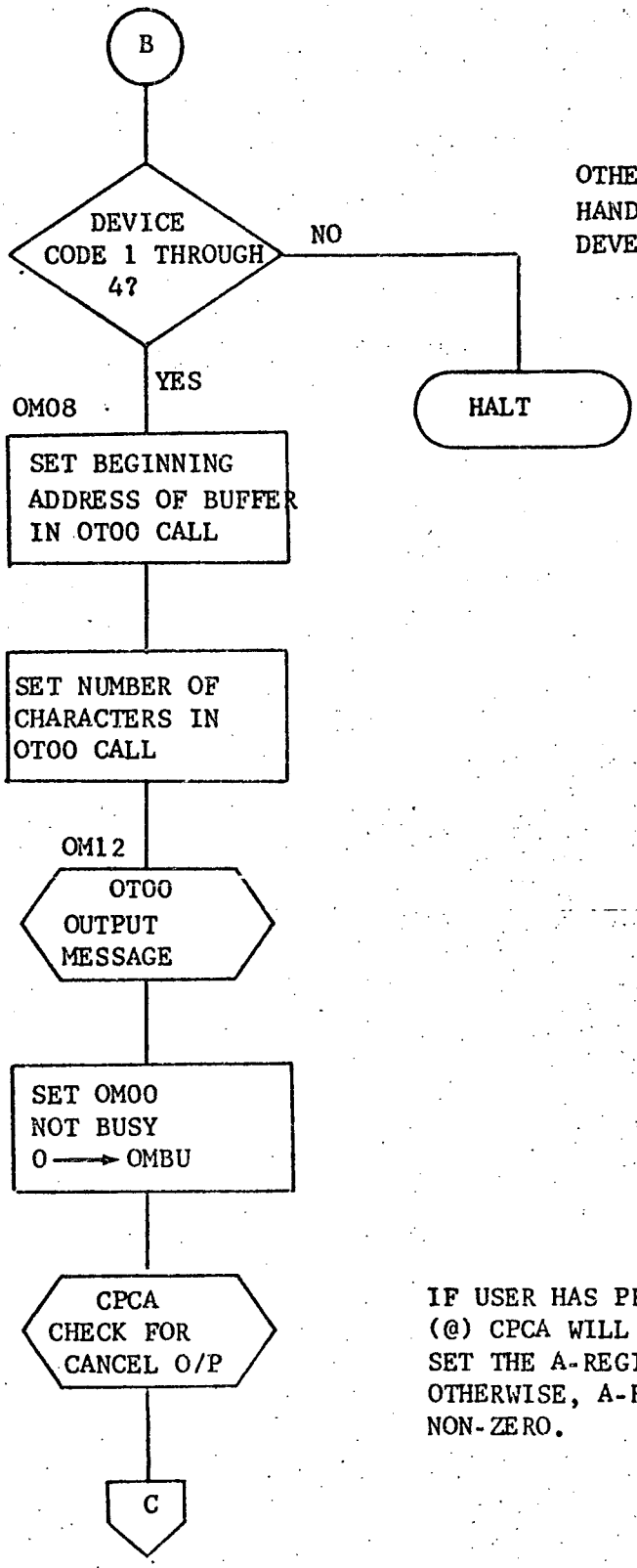
3.3.21.3.4 External References

OTLC Line count for each page output - defined in output teletype (OT00)

OT00 Output handler routine for both CLINC TTY's, DOC TTY, and DOC 103 Modem.

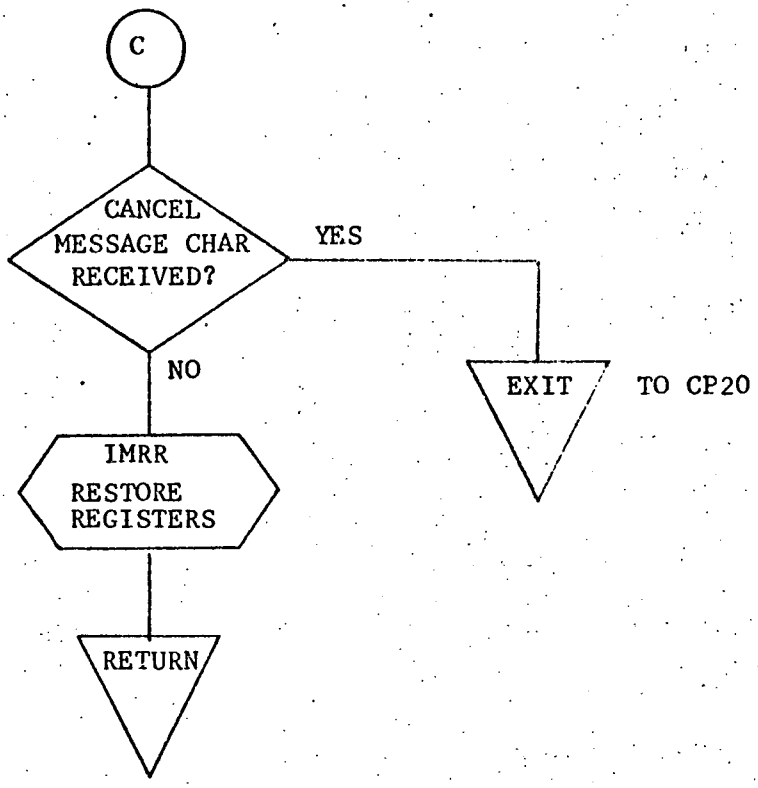
3.3.21.4 Detailed Flow Chart

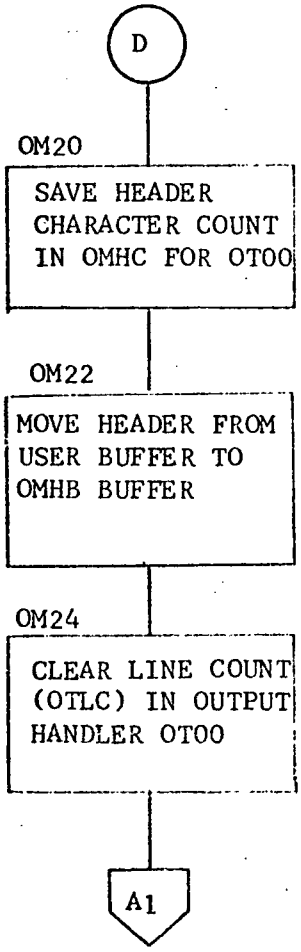




OTHER DEVICE I/O HANDLERS TO BE DEVELOPED.

IF USER HAS PRESSED THE AT SIGN (@) CPCA WILL DETECT IT AND SET THE A-REGISTER TO 0. OTHERWISE, A-REGISTER WILL BE NON-ZERO.





THE TOP OF PAGE HEADING WILL BE PRINTED FROM OMHB WHEN A TOP OF PAGE CONDITION IS ENCOUNTERED BY OTOO.

3.3.22 OS00 - Operator Search

3.3.22.1 Purpose

The Operator Search Subroutine (OS00) checks the temporary input buffer for the operators 'AND' and 'OR'.

3.3.22.2 Technical Description

OS00 checks the temporary input buffer for the operators 'AND' and 'OR'. If the operator 'AND' is found, Register-A is set to 1, and normal exit is taken. If the operator 'OR' is found, Register-A is set to zero and a normal exit is taken. If neither operator is found, the characters that were checked are packed in the request buffer; the condition count, RCCC, is incremented and an alternate exit is taken.

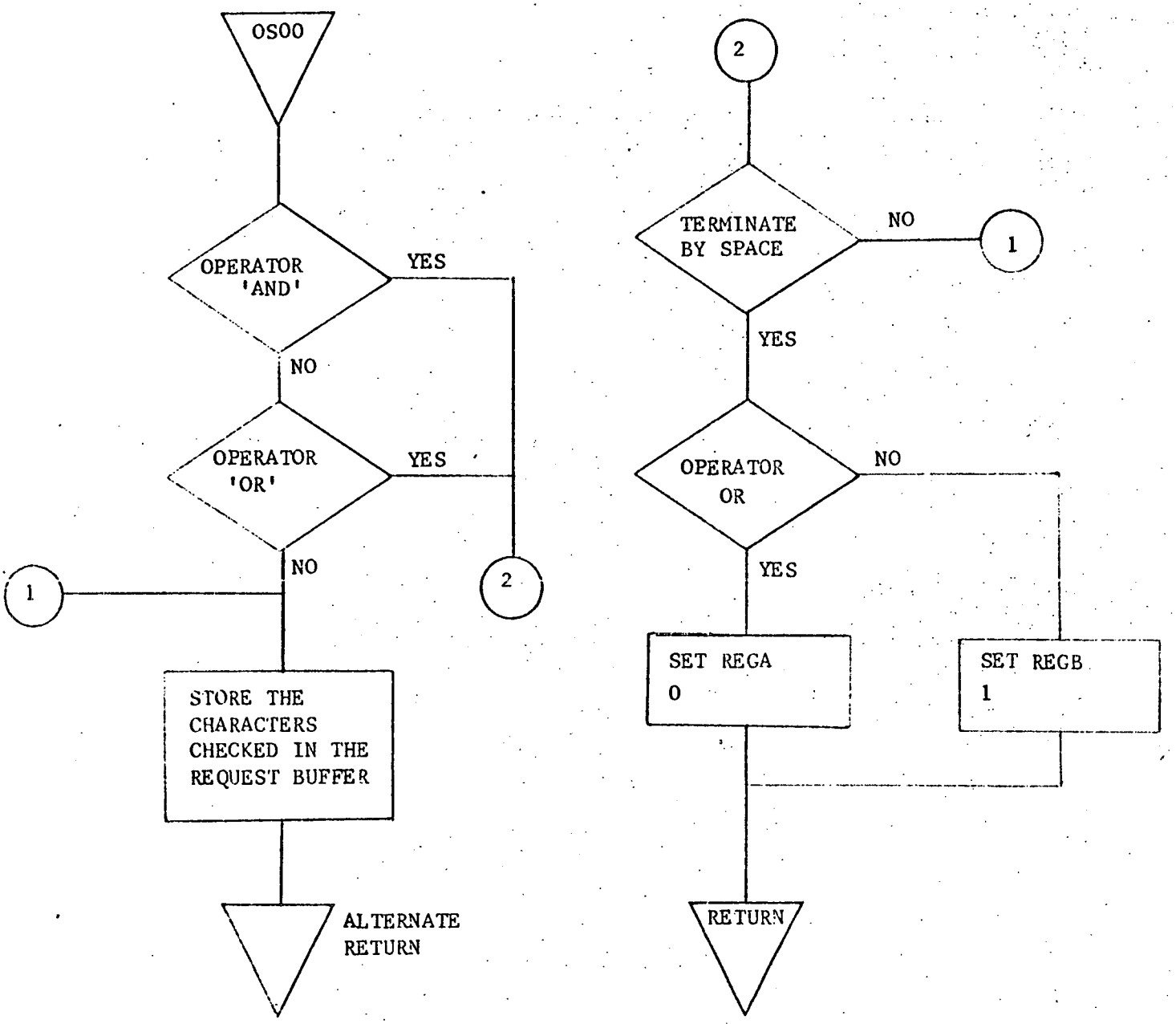
3.3.22.2.1 Calling Sequence

CALL OS00, Normal, Alternate

PARAMETER	FUNCTION
Normal	Address to be taken when match is found
Alternate	Address to be taken when no match is found

REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	N/A	0 for 'OR'; 1 for 'AND'
B	N/A	Modified
X	N/A	Modified
Overflow	N/A	Same

3.3.10.2.2 General Flow Chart



3.3.22.3 Label Description

3.3.22.3.1 Local

OSAR Address of no match exit

OSBL Table of five word to store check characters

OSNR Address of match exit

3.3.22.3.2 Global

None

3.3.22.3.3 Entry Point

OS00

3.3.22.3.4 External References

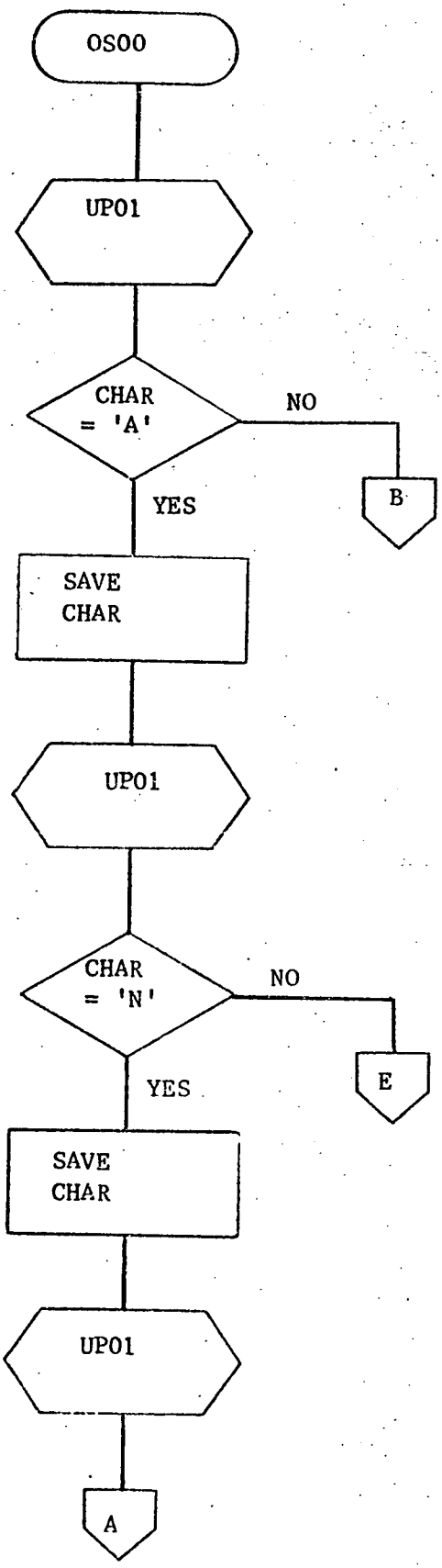
PK01 Entry point of subroutine to pack character into buffer

RCCC Condition count defined in RC00

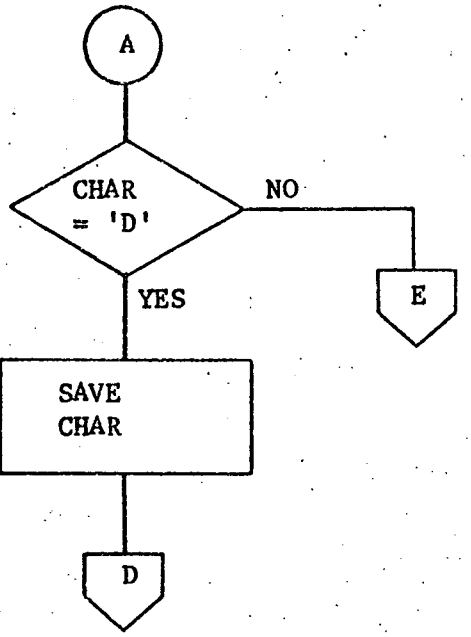
UP01 Entry Point of subroutine to unpack character from buffer

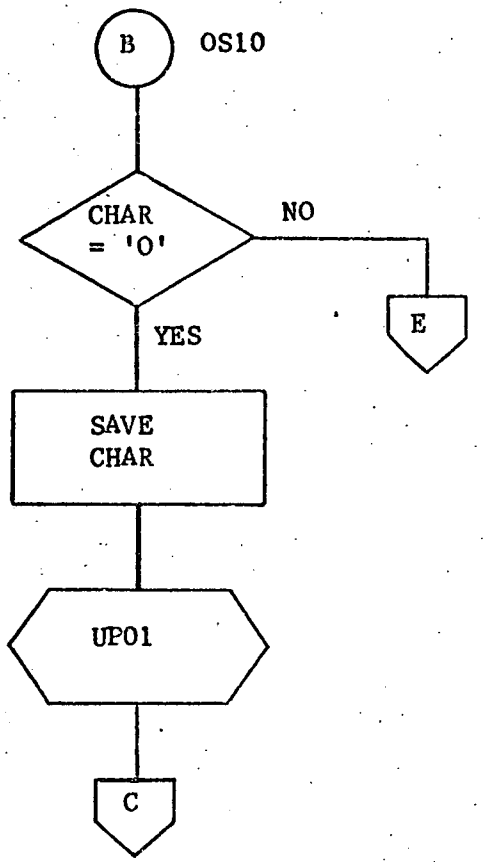
$SE Subroutine Save parameter list

3.3.22.4 Detailed Flow Chart



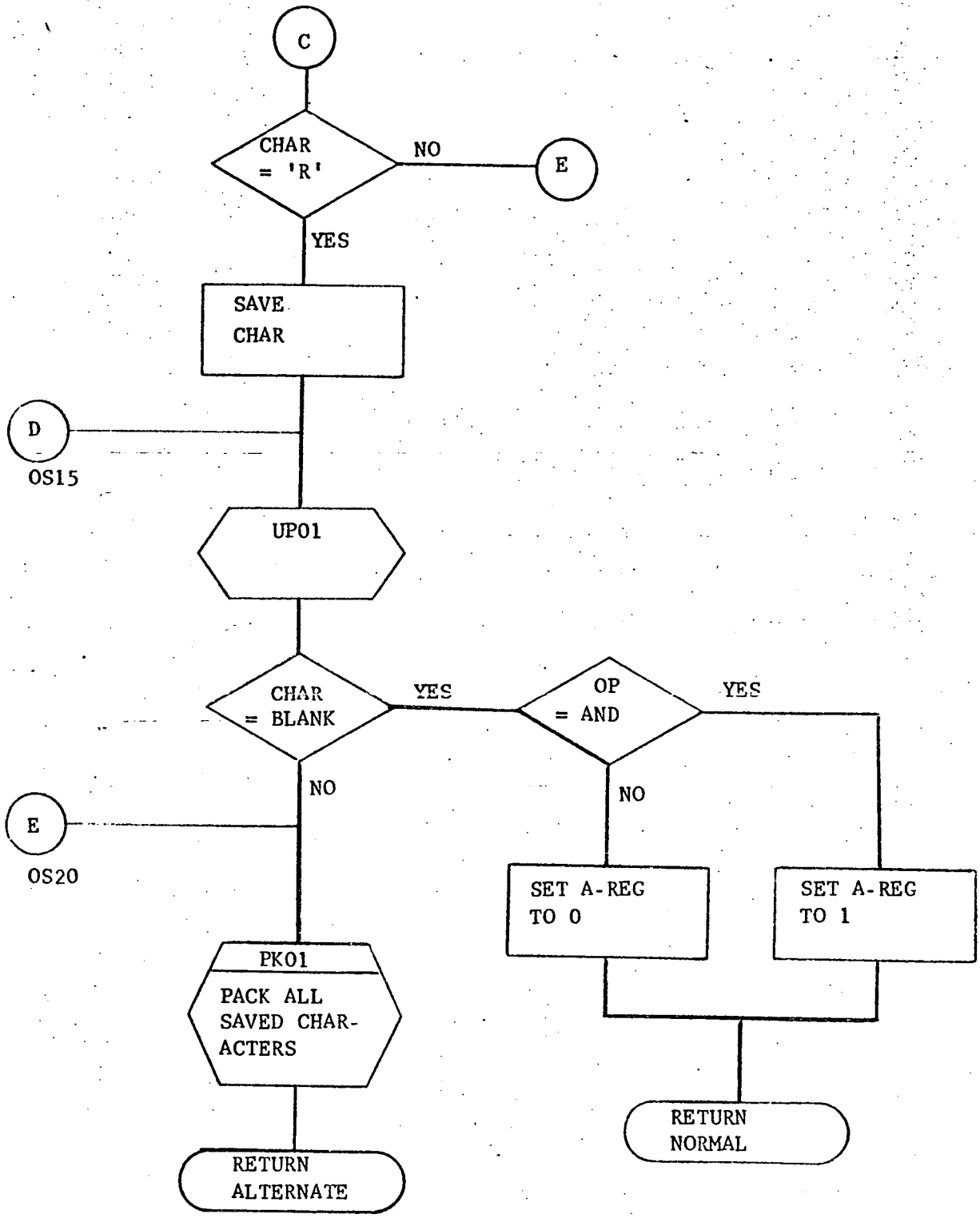
II.G.180


A
CHAR
= 'D'
NO
E
YES
SAVE
CHAR
D


B
OS10
CHAR
= 'O'
NO
E
YES
SAVE
CHAR
UP01
C

OR

II.G.190


C
CHAR
= 'R'
NO
E
YES
SAVE
CHAR
D
OS15
UP01
CHAR
= BLANK
YES
OP
= AND
YES
NO
NO
E
OS20
SET A-REG
TO 0
SET A-REG
TO 1
PK01
PACK ALL
SAVED CHAR-
ACTERS
RETURN
NORMAL
RETURN
ALTERNATE

3.3.23 OT00 - Output Teletype or 103 Modem

3.3.23.1 Purpose

The purpose of OT00 is to output a buffer to the CLINC TTY's, DOC TTY, or DOC 103 Modem.

3.3.23.2 Technical Description

OT00 gains control when it is called by the generalized Output Message (OM00) Routine. OT00 uses OM00 as a link back to the calling program to obtain the address of the data buffer, the address of the character count, and the address of an operation status word. The complete buffer is transmitted before the status word is set with a completed status and control is returned to OM00. As soon as character interrupts are available on the DOC computer systems, OT00 may be modified to return control to the original calling program when output of the first character is initiated. OT00 is presently designed to unpack the user buffer (packed three characters per word) and output a character at a time via the output character routine (OZKC). The output instructions in OZKC are set up for the output device by the Initialize System (IS00) Routine. The write buffer is sensed for a ready status by OZKC to determine when the next character may be output.

In addition to transmitting the output buffer, OT00 performs several other functions. A line count (OTLC) is maintained by OT00 for the purpose of paging the output. The line count is decremented every time

a line feed (LF) is detected in the output buffer. If the line count reaches zero, OT00 checks to see if a heading is to be printed at the top of the new page. If there is a heading requirement, OT00 outputs 5 carriage returns and line feeds, and prints the heading from the heading buffer (OMHB) where it was previously saved by OM00. The original calling program may have OM00 save the heading for subsequent output by placing an ASCII FORM character as the first character of the heading in the output buffer. If there is not a heading requirement, five carriage returns - line feeds are output by OT00. The original calling program may cause a top of page to occur on any line by placing an ASCII SOM character in the output buffer. Upon detecting the SOM character, OT00 performs the same processing as that performed when the line count reaches zero.

Upon completion of the output, the calling program operation status word is updated to contain the number of characters processed from the user supplied buffer. Control is returned to the OM00 routine which checks for a cancel output request, restores the user's registers, and returns to the user.

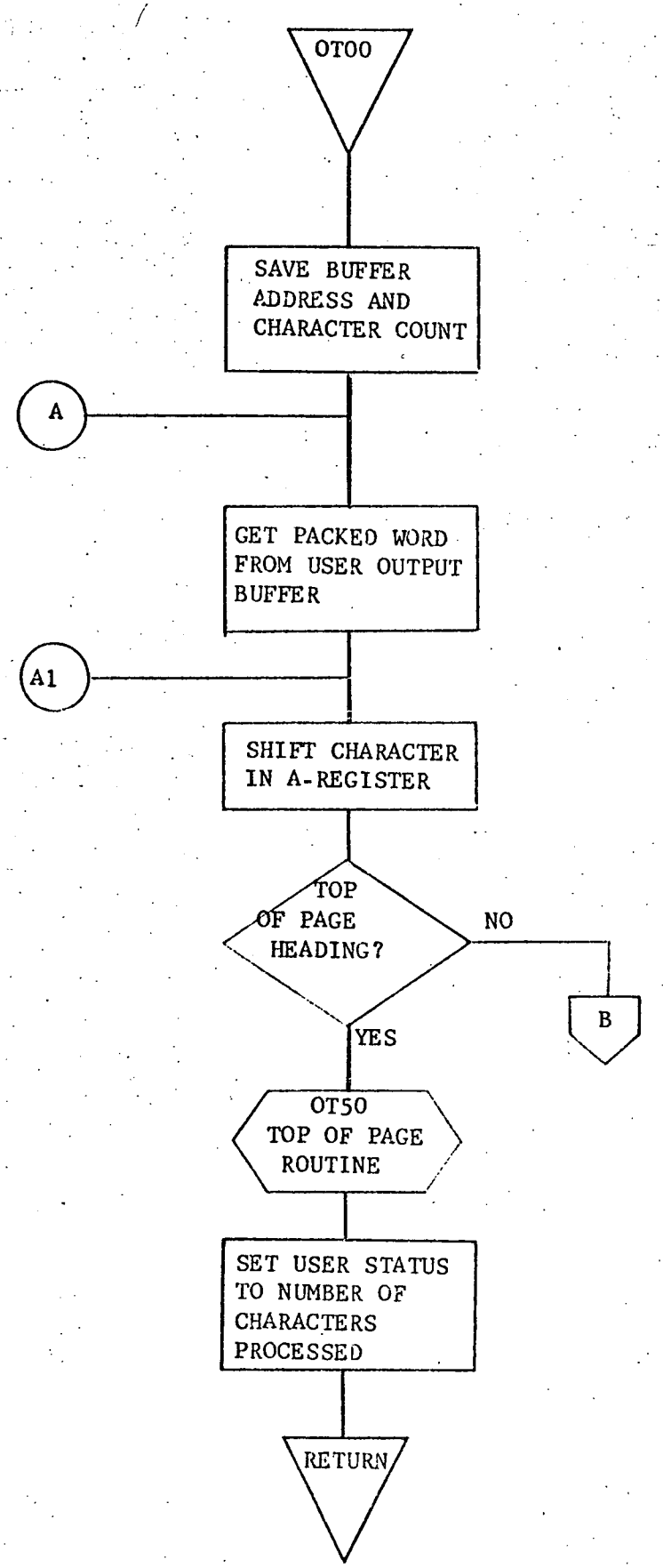
3.3.23.2.1 Calling Sequence

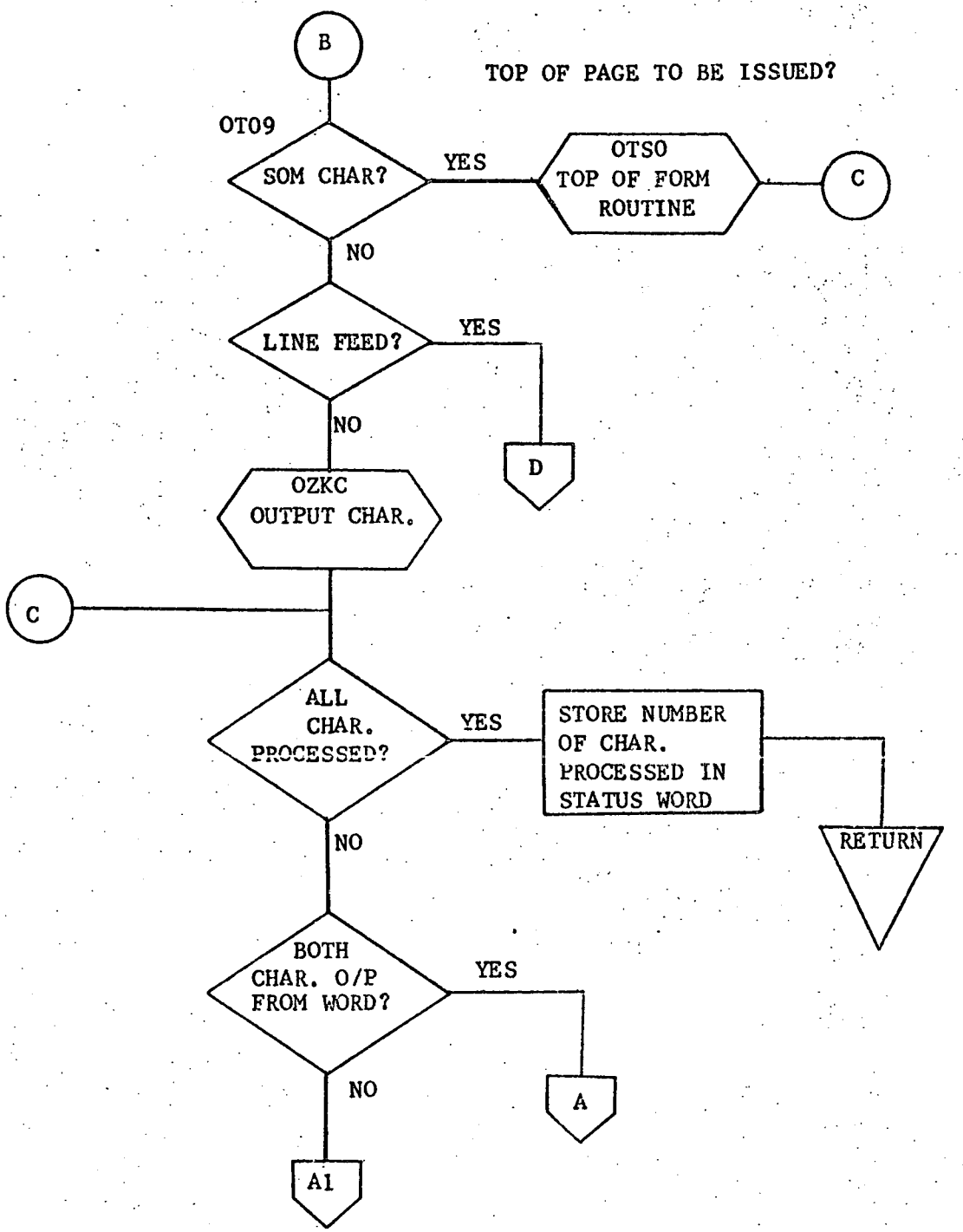
```
CALL    OT00,A,B
```

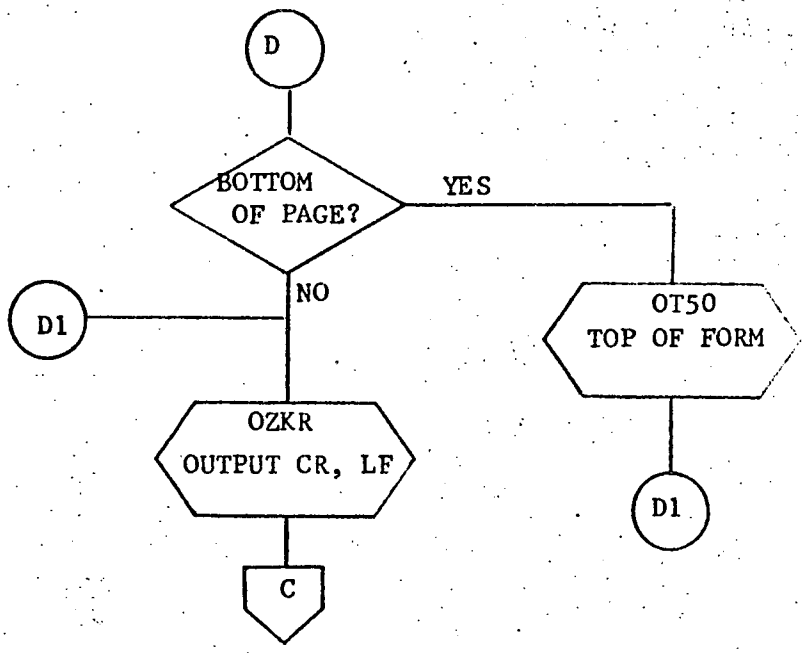
PARAMETER	FUNCTION
A	Beginning address of output buffer.
B	Number of characters in output buffer to be processed.

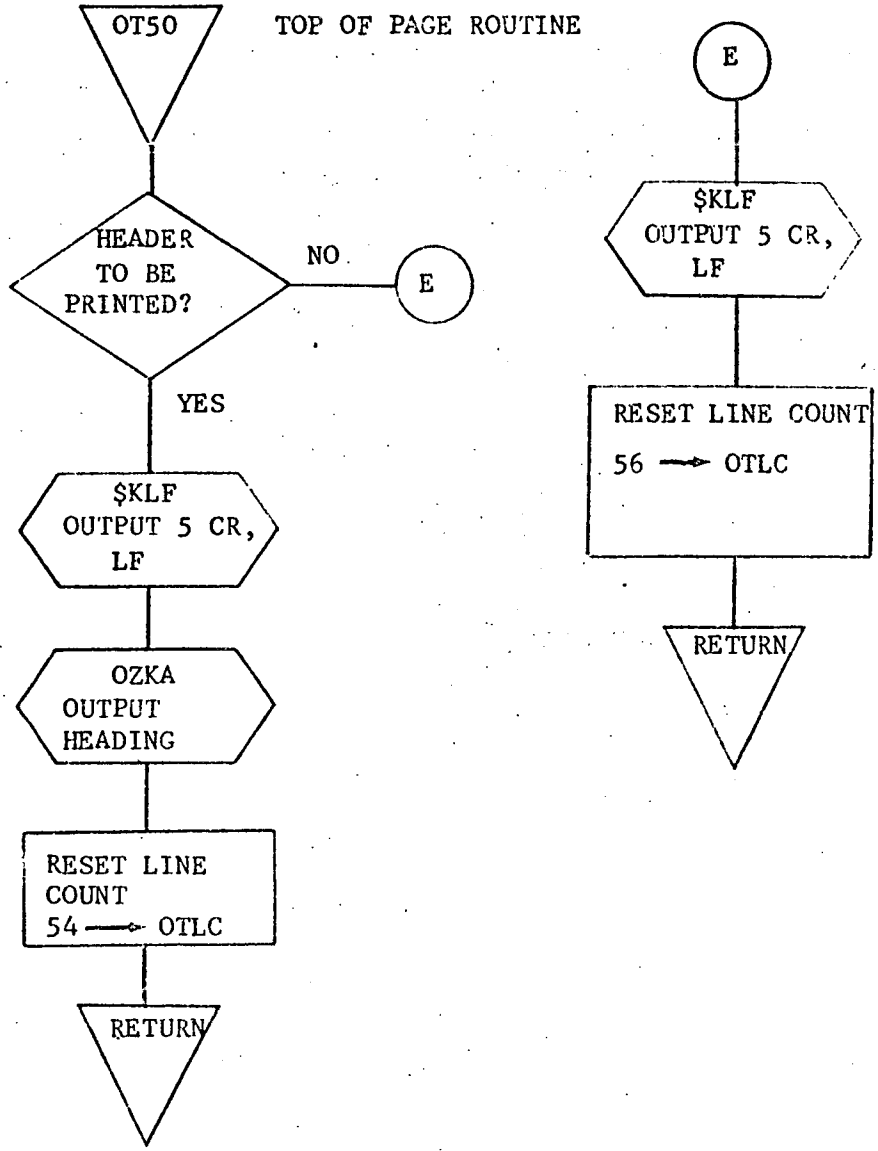
REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	N/A	Modified
B	N/A	Modified
X	N/A	Modified
Overflow	N/A	Modified

3.3.23.2.2 General Flow Chart




B
TOP OF PAGE TO BE ISSUED?
OT09
SOM CHAR?
YES
OTSO
TOP OF FORM
ROUTINE
C
NO
LINE FEED?
YES
NO
D
OZKC
OUTPUT CHAR.
C
ALL
CHAR.
PROCESSED?
YES
STORE NUMBER
OF CHAR.
PROCESSED IN
STATUS WORD
RETURN
NO
BOTH
CHAR. O/P
FROM WORD?
YES
NO
A
A1


D
BOTTOM OF PAGE?
YES
NO
D1
OT50 TOP OF FORM
OZKR OUTPUT CR, LF
D1
C


OT50
TOP OF PAGE ROUTINE
HEADER TO BE PRINTED?
NO
E
YES
$KLF OUTPUT 5 CR, LF
OZKA OUTPUT HEADING
RESET LINE COUNT
54 → OTLC
RETURN
E
$KLF OUTPUT 5 CR, LF
RESET LINE COUNT
56 → OTLC
RETURN

3.3.23.3 Label Description

3.3.23.3.1 Local

OTA	Save A location
OTB	Save B location
OTBA	Output Buffer Address
OTCC	Number of characters in output buffer
OTCP	Number of characters processed
OTOF	Save overflow location
OTSV	Save character location
OTX	Save X location

3.3.23.3.2 Global

OTLC	Line count - initialized by OM00

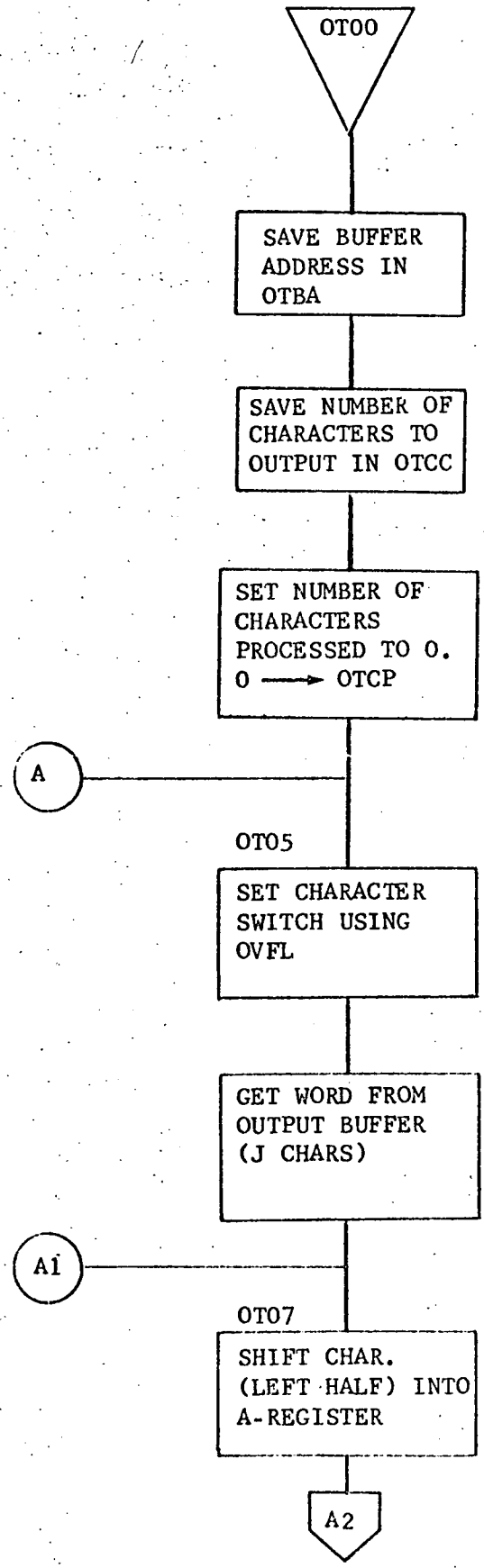
3.3.23.3.3 Entry Points

OT00

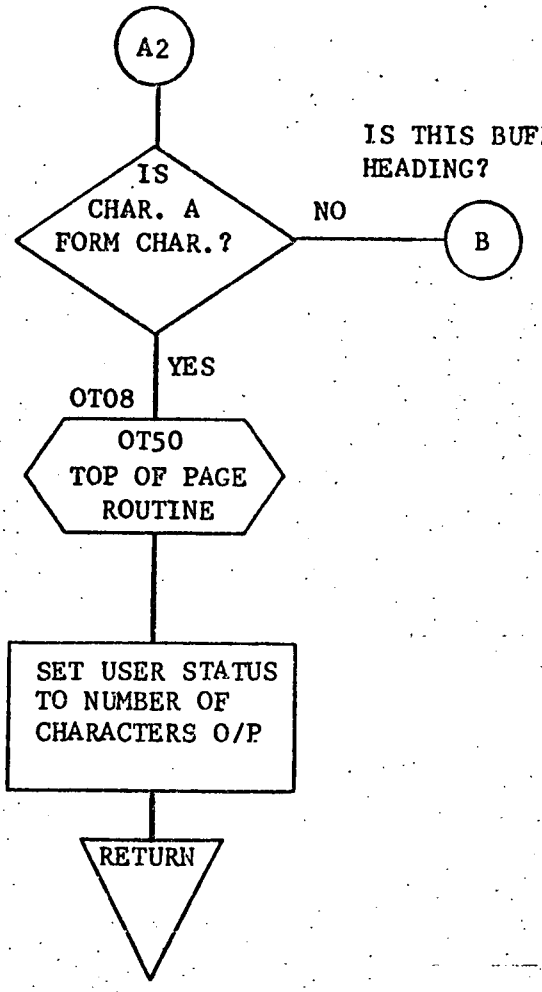
3.3.23.3.4 External References

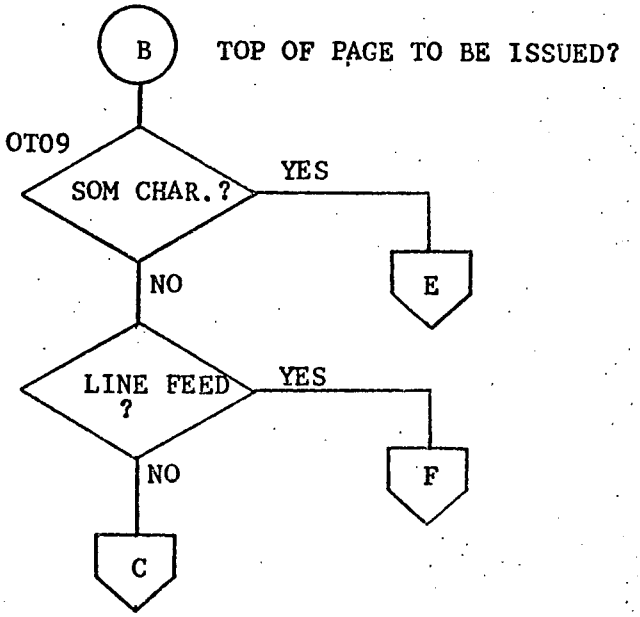
OMHB	Top of Page output buffer
OMHC	Number of characters in user top of page output buffer (OMHB)
OMOS	Address of user operation status word - defined in OM00
OZKA	Subroutine used to output OMHB
OZKC	Subroutine to output one character to TTY or Modem
OZKR	Subroutine to output a CR, LF to TTY or Modem
$KLF	Subroutine to output n number of CR, LF to TTY or Modem

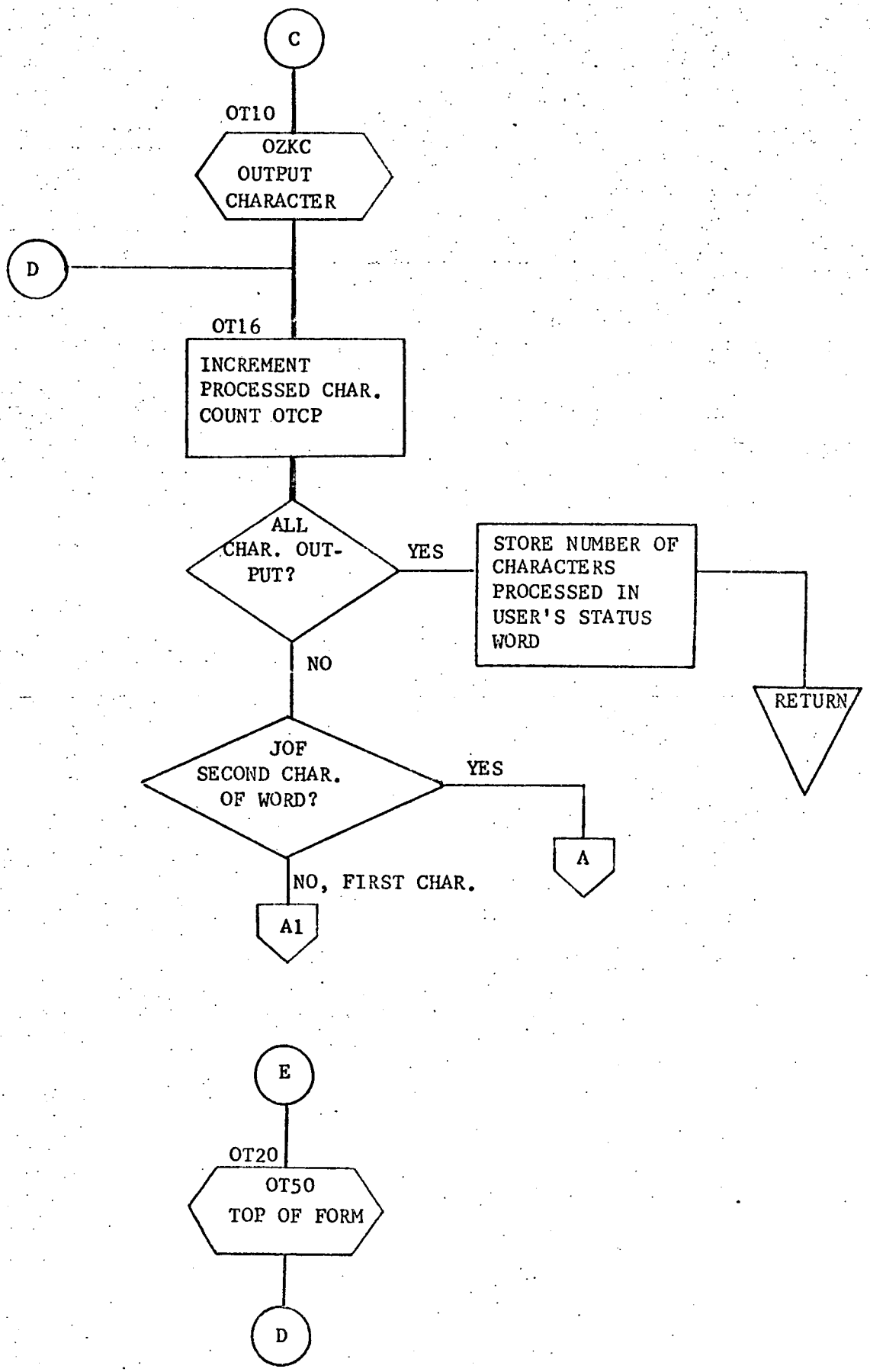
3.3.23.4 Detailed Flow Chart

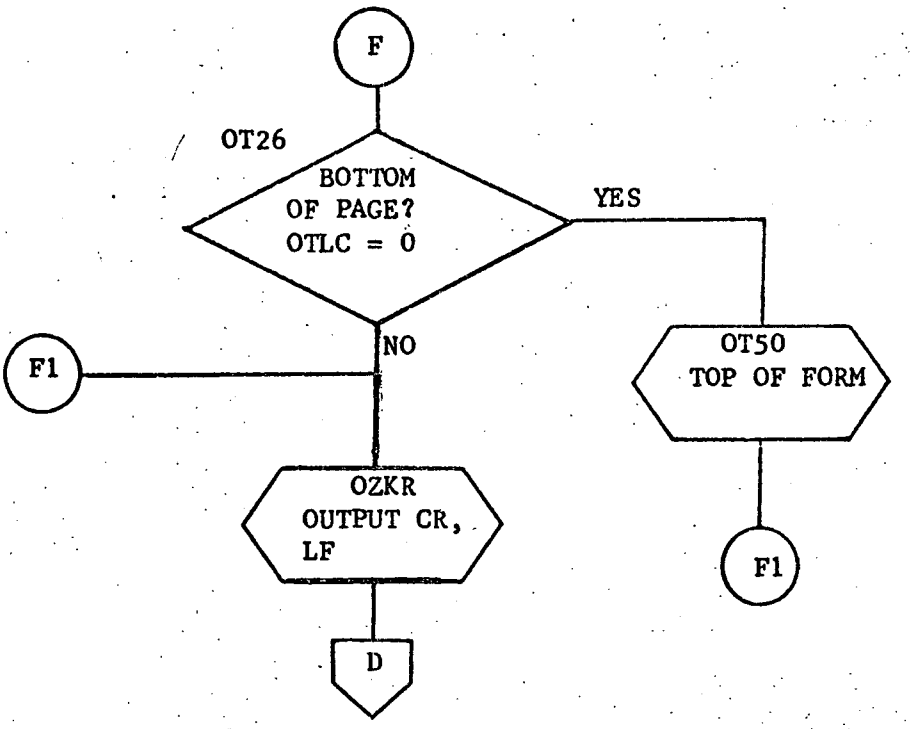


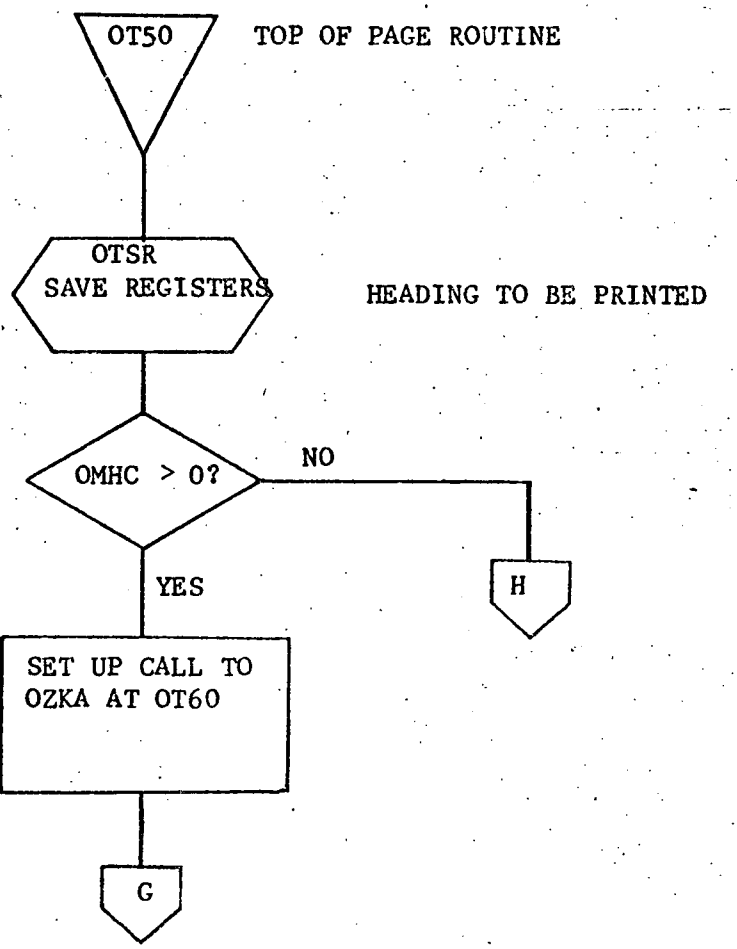
OVERFLOW INDICATOR IS USED TO DETERMINE WHETHER TO OUTPUT LEFT OR RIGHT HALF OF PACKED WORD FROM BUFFER.

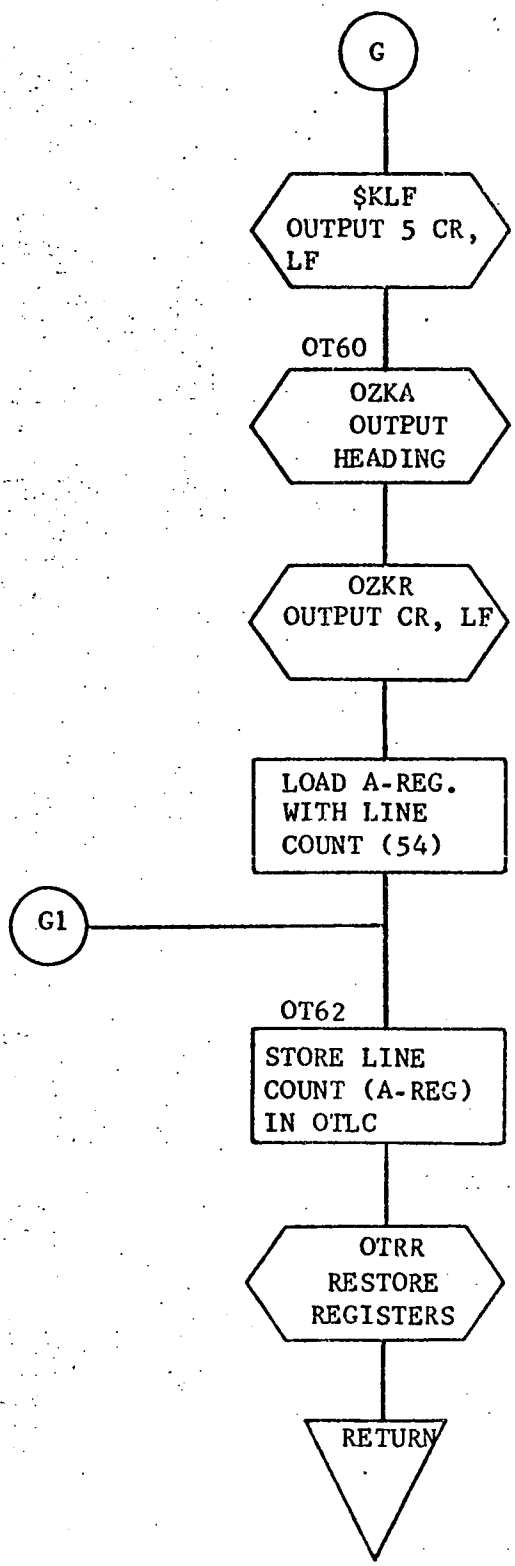

A2
IS THIS BUFFER A TOP OF PAGE HEADING?
IS CHAR. A FORM CHAR.?
NO
B
YES
OT08
OT50 TOP OF PAGE ROUTINE
SET USER STATUS TO NUMBER OF CHARACTERS O/P
RETURN

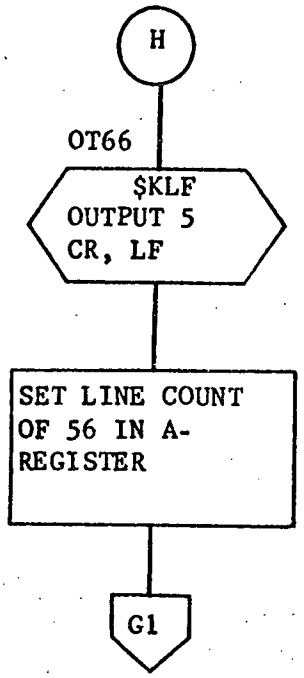

B
TOP OF PAGE TO BE ISSUED?
OT09
SOM CHAR.?
YES
E
NO
LINE FEED ?
YES
F
NO
C

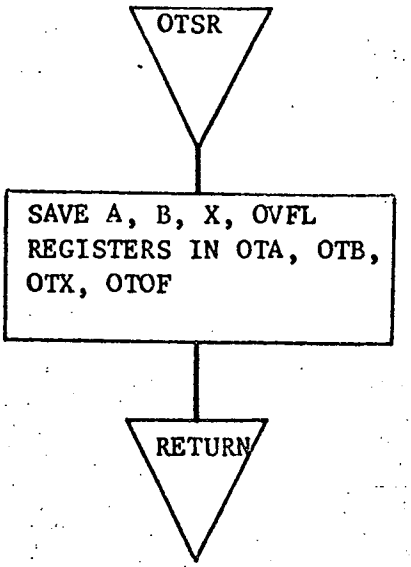

C
OT10
OZKC
OUTPUT
CHARACTER
D
OT16
INCREMENT
PROCESSED CHAR.
COUNT OTCP
ALL
CHAR. OUT-
PUT?
YES
STORE NUMBER OF
CHARACTERS
PROCESSED IN
USER'S STATUS
WORD
RETURN
NO
JOF
SECOND CHAR.
OF WORD?
YES
A
NO, FIRST CHAR.
A1
E
OT20
OT50
TOP OF FORM
D

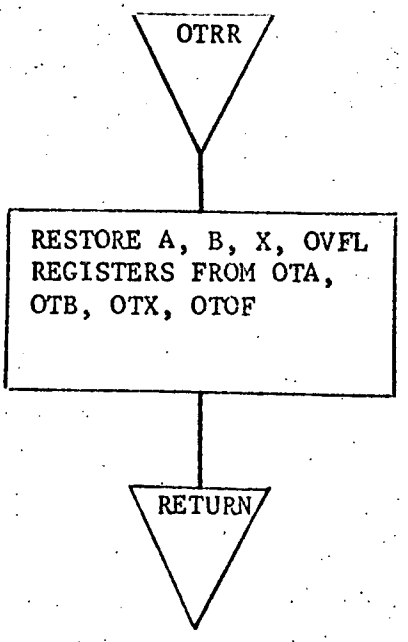

F
OT26
BOTTOM OF PAGE? OTLC = 0
YES
NO
F1
OT50 TOP OF FORM
OZKR OUTPUT CR, LF
F1
D


OT50
TOP OF PAGE ROUTINE
OTSR SAVE REGISTERS
HEADING TO BE PRINTED
OMHC > 0?
NO
YES
H
SET UP CALL TO OZKA AT OT60
G


G
$KLF
OUTPUT 5 CR, LF
OT60
OZKA
OUTPUT HEADING
OUTPUT HEADING FROM OMHB
OZKR
OUTPUT CR, LF
LOAD A-REG. WITH LINE COUNT (54)
G1
OT62
STORE LINE COUNT (A-REG) IN OTLC
OTRR
RESTORE REGISTERS
RETURN


H
OT66
$KLF
OUTPUT 5
CR, LF
SET LINE COUNT
OF 56 IN A-
REGISTER
G1


OTSR
SAVE A, B, X, OVFL
REGISTERS IN OTA, OTB,
OTX, OTOF
RETURN


OTRR
RESTORE A, B, X, OVFL
REGISTERS FROM OTA,
OTB, OTX, OTOF
RETURN

3.3.24 OZKC - Output Character to TTY

3.3.24.1 Purpose

This routine outputs one character to the ASR-35 teletype.

3.3.24.2 Technical Description

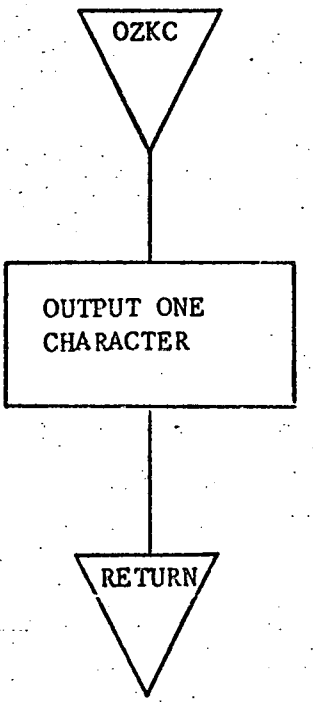
NA

3.3.24.2.1 Calling Sequence

CALL OZKC

The A-register contains the character to be output.

3.3.24.2.2 General Flow Chart



3.3.24.3 Label Description

3.3.24.3.1 Local Labels

None

3.3.24.3.2 Global

None

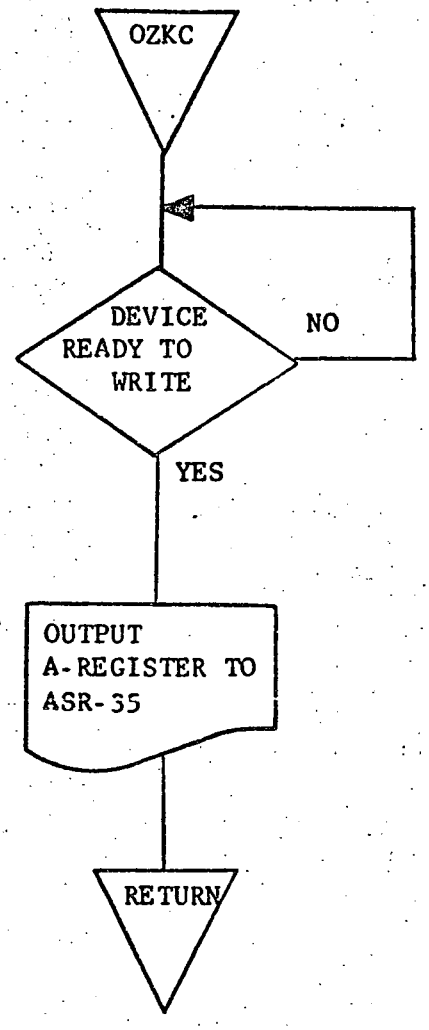
3.3.24.3.3 Entry Point

Primary entry point OZKC

3.3.24.3.4 External References

None

3.3.24.4 Detailed Flow Chart



3.3.25 OZKB - output character to TTY

3.3.25.1 Purpose

This routine outputs the contents of the B-register to the KSR-35 each time it is called.

3.3.25.2 Technical Description

N/A

3.3.25.1 Calling Sequence

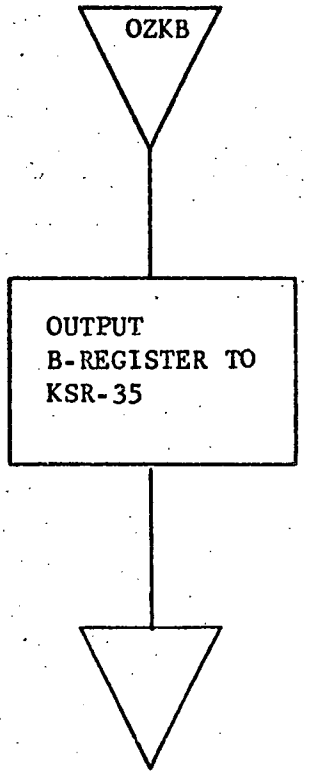
CALL OZKB

PARAMETER

None

REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	undisturbed	
B	ASCII character code to be output	same
X	undisturbed	
Overflow	undisturbed	

3.3.25.2.2 General Flow Chart



3.3.25.3.1 Local

None

3.3.25.3.2 Global

None

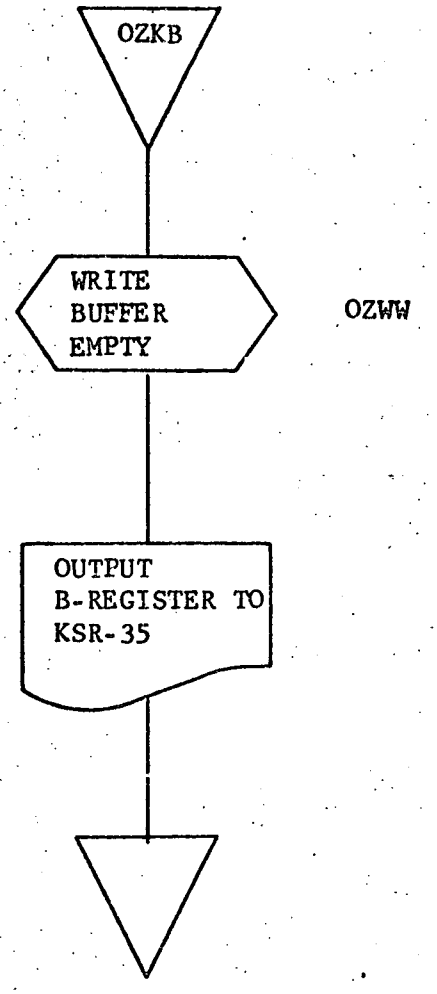
3.3.25.3.3 Entry Points

OZKB - primary entry point

3.3.25.3.4 External References

OZWW - check write buffer empty (from routine OZKR)

3.3.25.4 Detailed Flow Chart



3.3.26 OZKA - Print Buffer on TTY

3.3.26.1 Purpose

This routine outputs characters to the ASR-35 teletype.

3.3.26.2 Technical Description

This routine outputs a buffer to the ASR-35 teletype. Each buffer word should contain two eight bit ASCII characters. Both the beginning location to be output and the number of characters to print are specified by the calling routine.

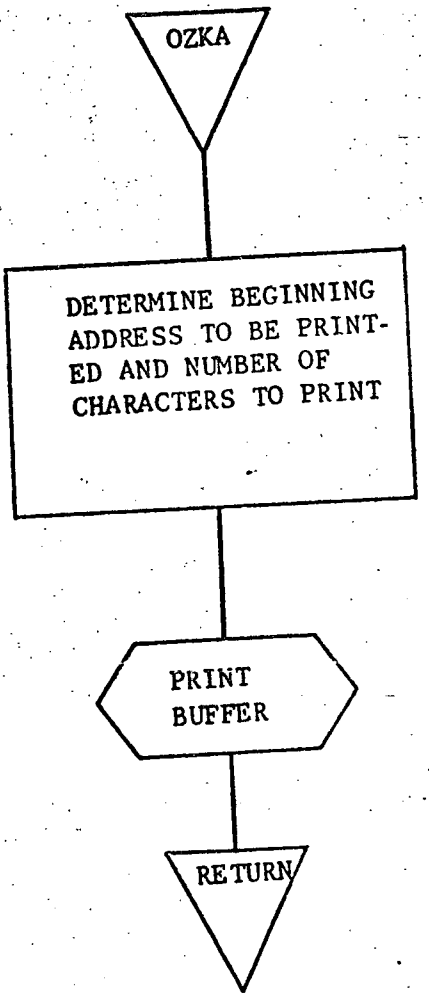
3.3.26.2.1 Calling Sequence

```
CALL   OZKA,START,N
```

PARAMETER	FUNCTION
START	beginning address to be printed
N	number of characters to print

REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	Saved	Restored
B	Saved	Restored
X	Saved	Restored
Overflow	Destroyed	

3.3.26.2.2 General Flow Chart



3.3.26.3 Label Description

3.3.26.3.1 Local Labels

Symbol	Function
OZ$1	contains address of next word to be output

3.3.26.3.2 Global Labels

Symbol	Function
SAVE	buffer used to save volatile registers

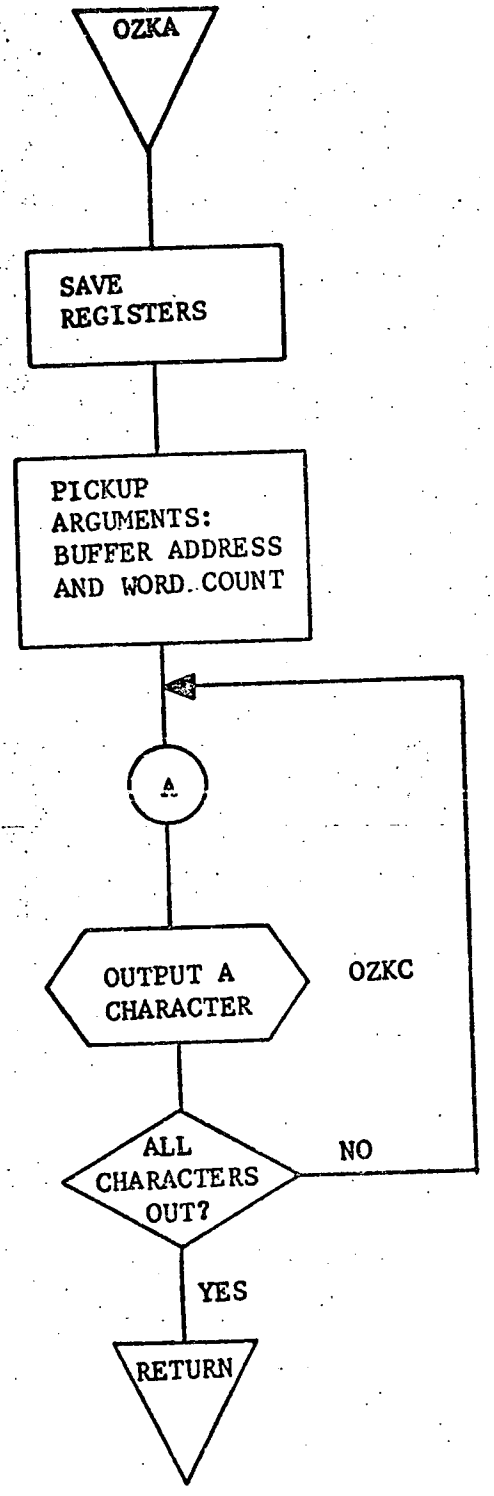
3.3.26.3.3 Entry Point

primary entry point - OZKA

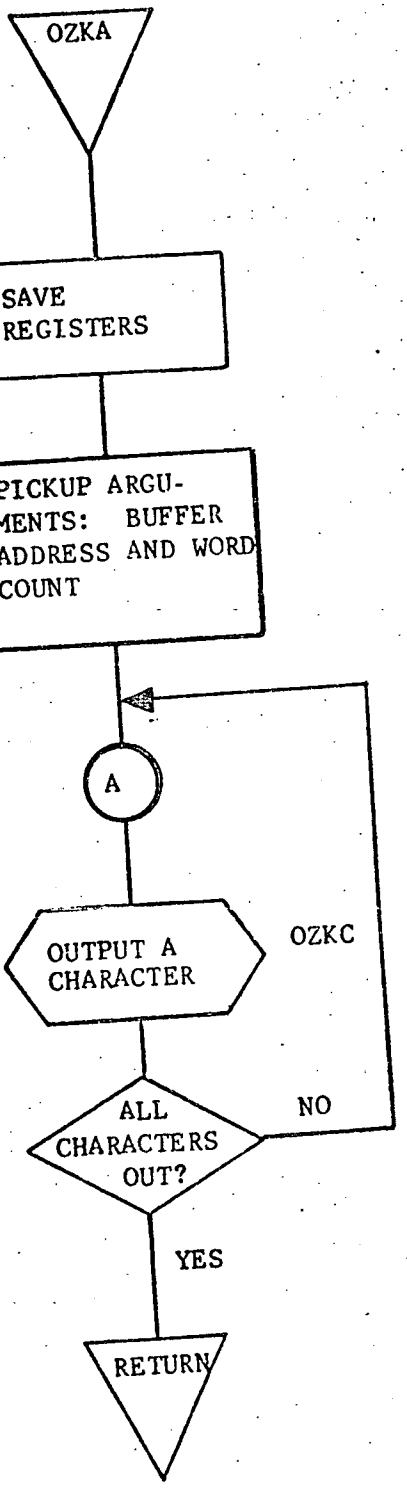
3.3.26.3.4 External References

OZKC - routine which outputs one character to the TTY

3.3.26.4 Detailed Flow Chart



3.3.26.4 Detailed Flow Chart



3.3.27 OZKR - carriage return and line feed

3.3.27.1 Purpose

This routine outputs a carriage return and line feed to the KSR-35 teletype.

3.3.27.2 Technical Description

N/A

3.3.27.2.1 Calling Sequence

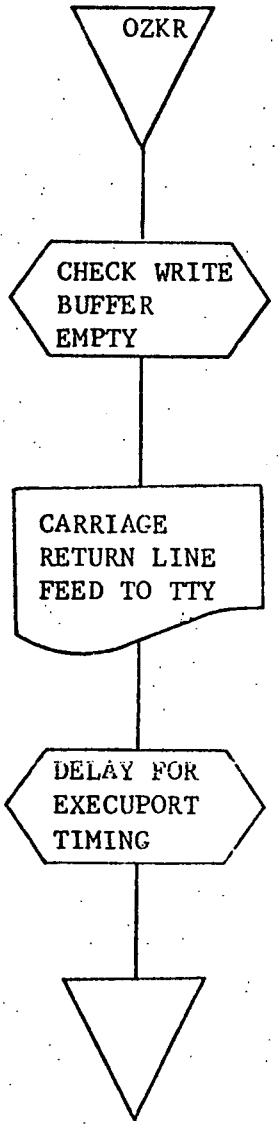
```
CALL  OZKR
```

PARAMETER

None

REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	destroyed	
B	undisturbed	
X	saved	restored
Overflow	destroyed	

3.3.27.2.2 General Flow Chart



3.3.27.3 Label Description

3.3.27.3.1 Local

OZNX - contents of X-register

3.3.27.3.2 Global

None

3.3.27.3.3 Entry Points

OZKR - primary entry point

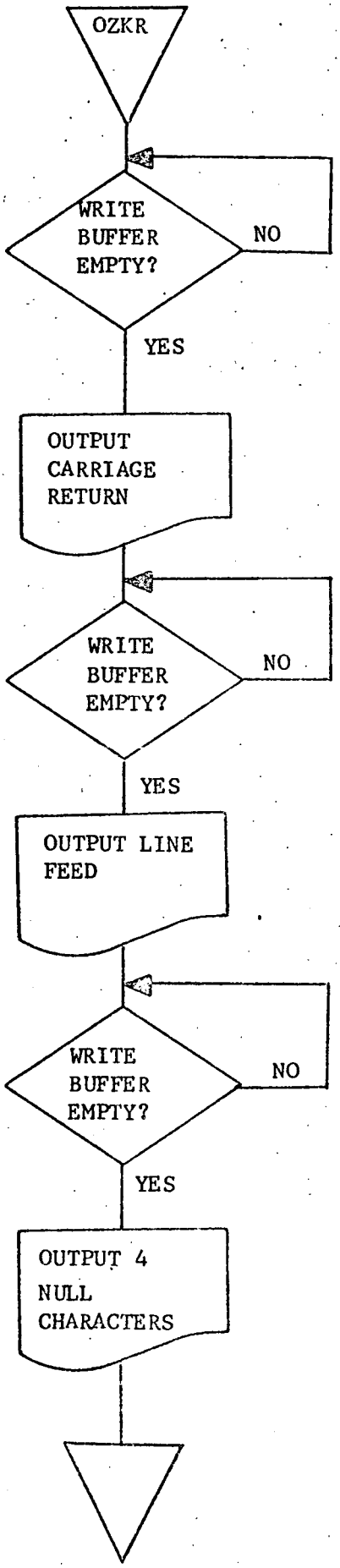
OZNN - entry to output null characters to TTY

OZWW - entry to sense write buffer empty

3.3.27.3.4 External References

None

3.3.27.4 Detailed Flow Chart



3.3.28 PF00 - power fail - restart

3.3.28.1 Purpose

Once a power failure occurs and power is restored, this routine will initiate the action for the restart of the retrieval system.

3.3.28.2 Technical Description

When a power failure occurs, the program being executed is terminated and prevailing program conditions are lost. Once power is restored, this routine notifies the operator that the system has gone off-line and must be reinstated. The teletype bell is rung several times and an appropriate message is printed.

3.3.28.2.1 Calling Sequence

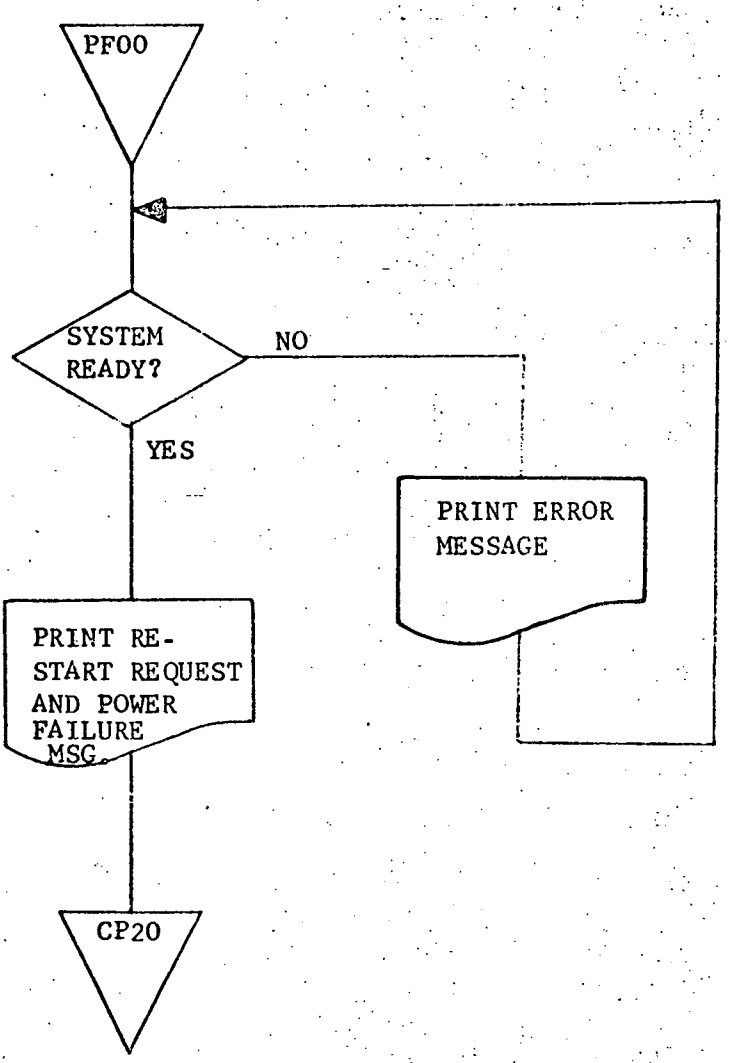
```
CALL     PF00
```

PARAMETER

None

REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	lost	
B	lost	
X	lost	
Overflow	lost	

3.3.28.2.2 General Flow Chart



3.3.28.3 Label Description

3.3.28.3.1 Local

PFSX contents of X-register.

3.3.28.3.2 Global

HMBU mag tape handler busy indicator

IMBU input message busy indicator

ISN6 count of words to be printed

ISQ6 address of message buffer to be printed

ISTU mag tape unit to be readied

OMBU output message busy indicator

OMHC output message heading indicator

TAPU output message heading indicator

3.3.28.3.3 Entry Points

location 040 is power fail entry; PF00 - primary entry point for restart

3.3.28.3.4 External References

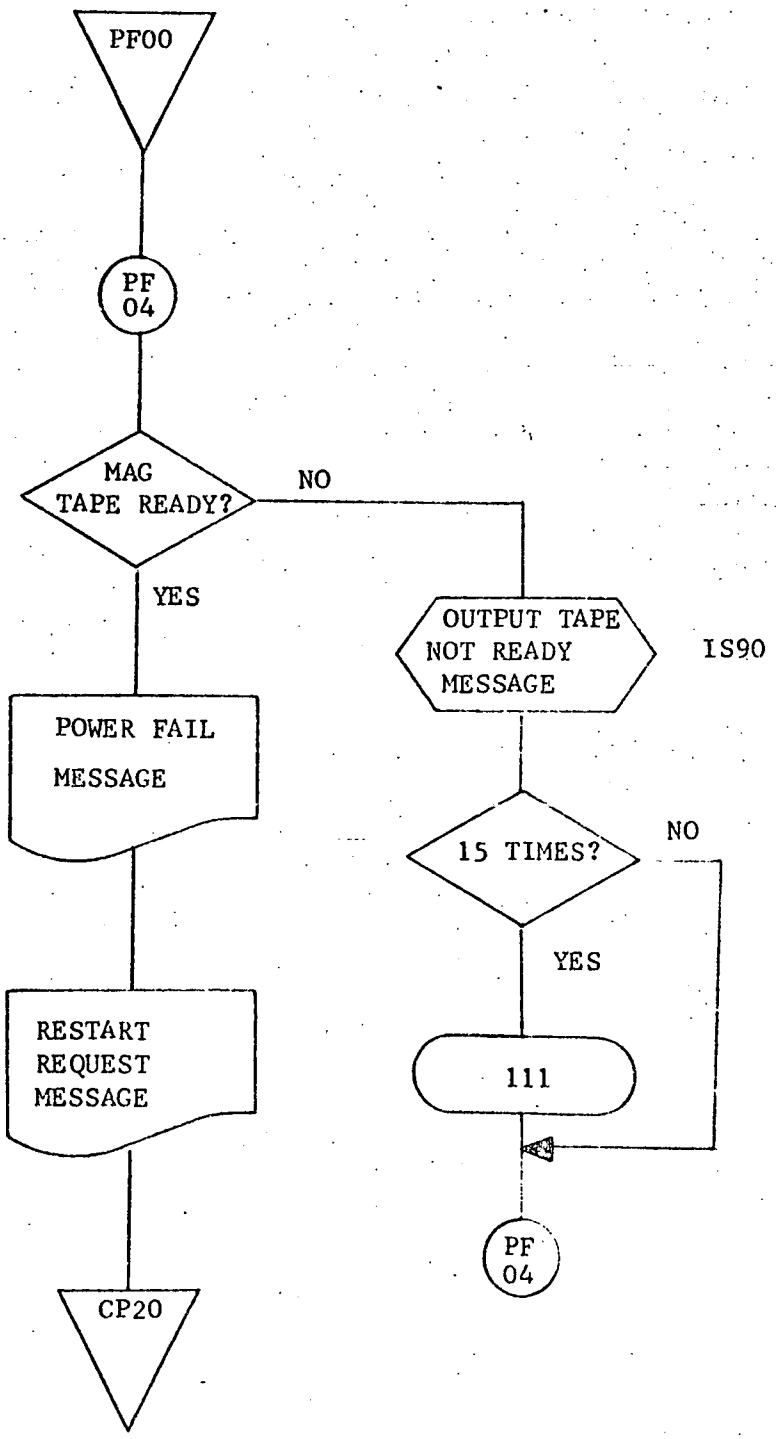
CP00 control program entry

CP20 end-action in CP00

ER00 error message output routine

IS90 output to teletype routine

3.3.28.4 Detailed Flow Chart



3.3.29 PK00 - Pack Character

3.3.29.1 Purpose

PK00 is a subroutine whose purpose is to accept ASCII characters one at a time and pack them into a buffer two characters per word in order to conserve computer memory.

3.3.29.2 Technical Description

PK00 has two entry points, PK00 and PK01. The first time the routine is called, control must be passed to PK00 with the first character to be packed in the A-register and the starting address of the destination buffer in the B-register. For all subsequent calls, control must be passed to PK01 with the data character in the A-register. The data will be packed two characters per word starting in the buffer address specified in the first call.

3.3.29.2.1 Calling Sequence

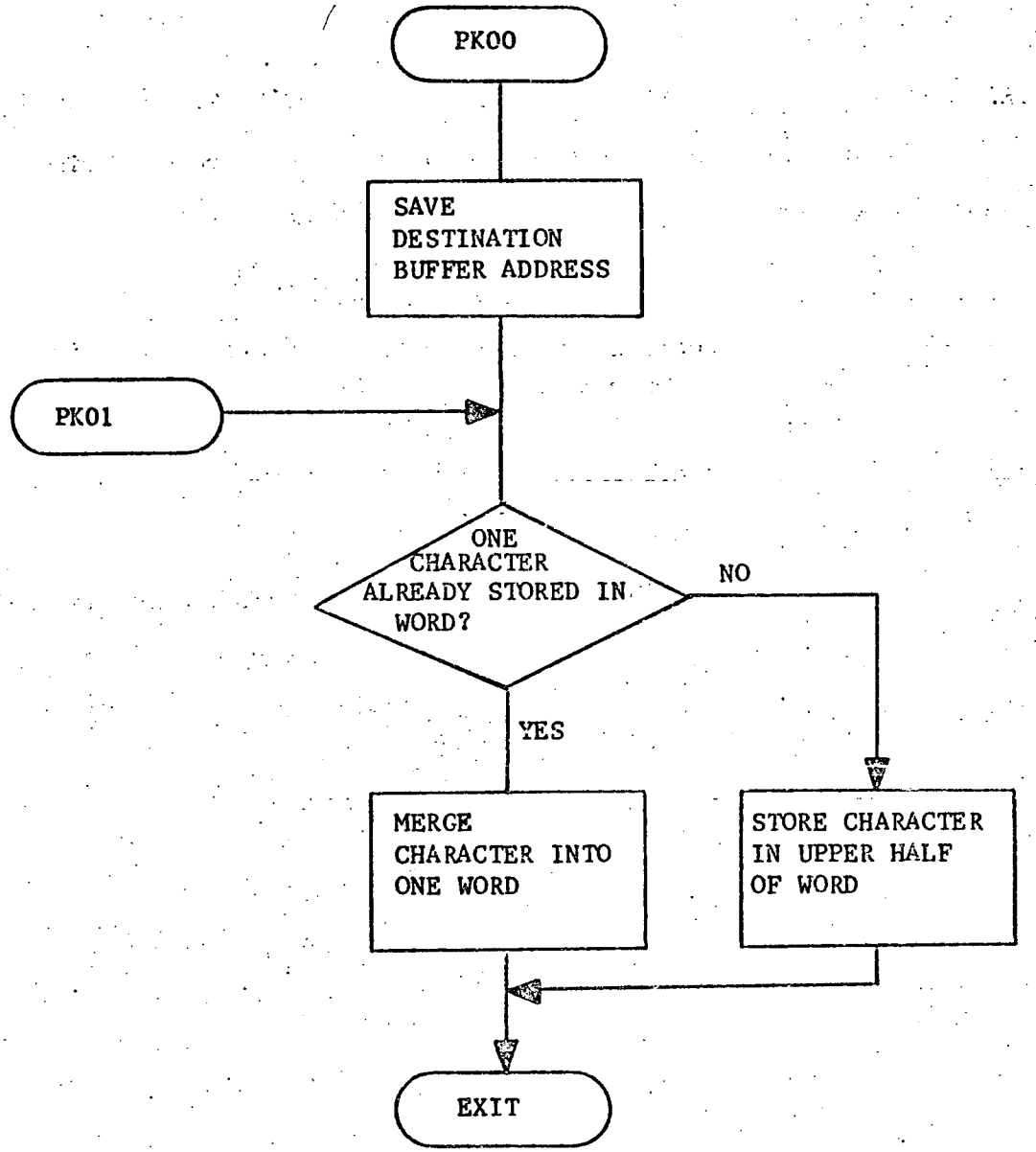
CALL PK00 (for initial call)

CALL PK01 (for all subsequent calls)

3.3.29.2.1 Calling Sequence (Continued)

REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	Character to store	Restored to original value
B	Destination Buffer address (initial call only)	Restored to original value
X	Saved upon entry	Restored to original value
Overflow	N/A	N/A

3.3.29.2.2 General Flow Chart



3.3.29.3 Label Description

3.3.29.3.1 Local

PKSA - temporary storage location for the contents of the A-register.

PKSB - temporary storage location for the contents of the B-register.

PKSX - temporary storage location for the contents of the X-register.

PKXX - storage location for the starting address of the destination buffer.

3.3.29.3.2 Global

PKBX - starting address of the destination buffer

PKIX - index into the destination buffer

PKSW - switch which controls into which half of a data word a character is to be put.

3.3.29.3.3 Entry Points

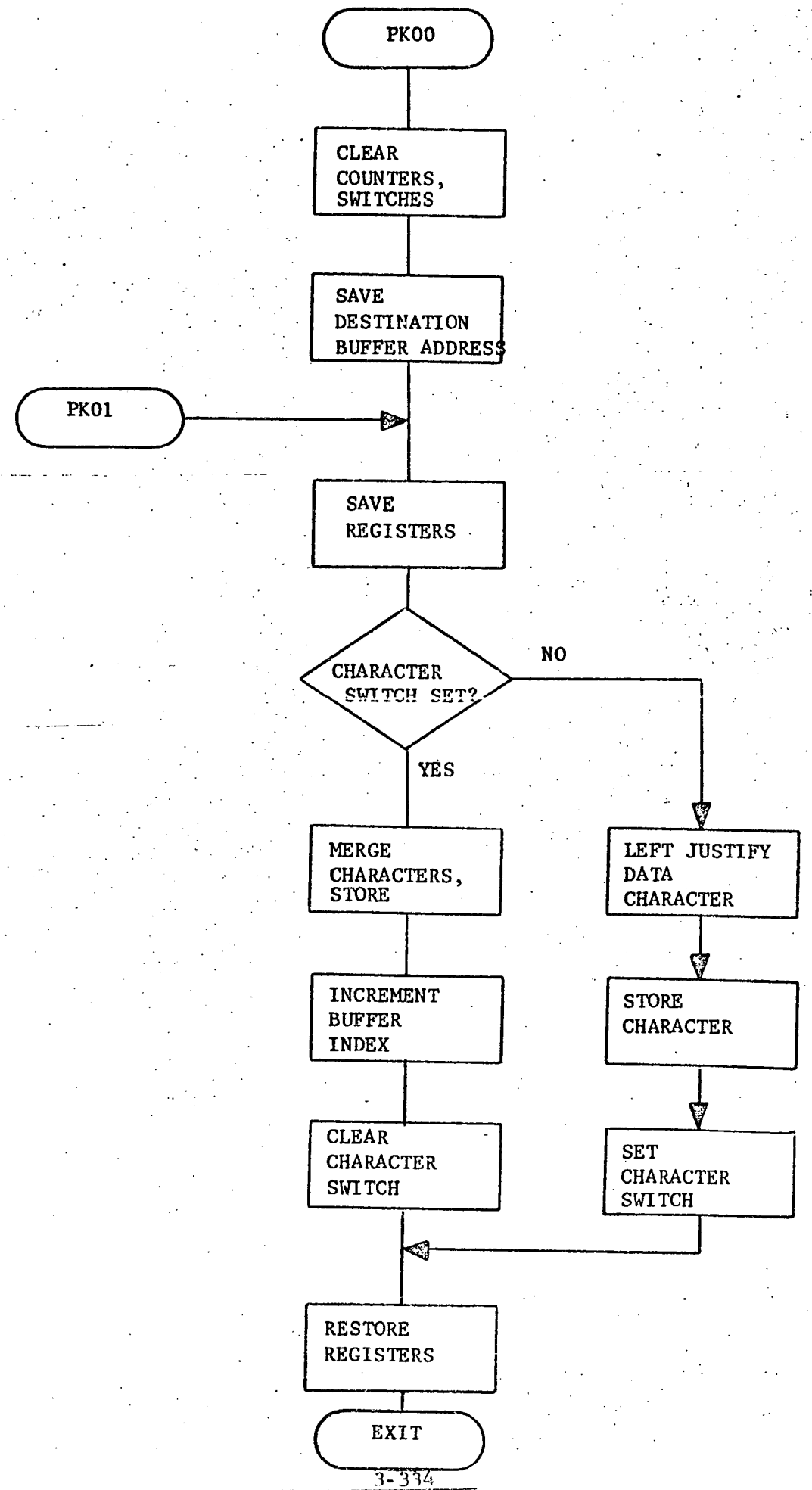
PK00 - entry point for the first call to this routine.

PK01 - entry point for all subsequent calls to this routine.

3.3.29.3.4 External References

None

3.3.29.4 Detailed Flow Chart



3.3.30 RA00 - Request Action

3.3.30.1 Purpose

RA00 is a subroutine whose purpose is to check the requested ACTION for List, Copy, Count, Tabulate or Analyze, and sets the Request Table entry accordingly.

3.3.30.2 Technical Description

RA00 validates the response from the user to the "ACTION" query. RA00 checks to see if less than four characters were input to the temporary input buffer. If less than four characters have been input, an error message, 'INVALID ACTION', is displayed, the question number (to permit a reissuance of "ACTION" query) is decremented, and control is returned to the calling routine (RQ00).

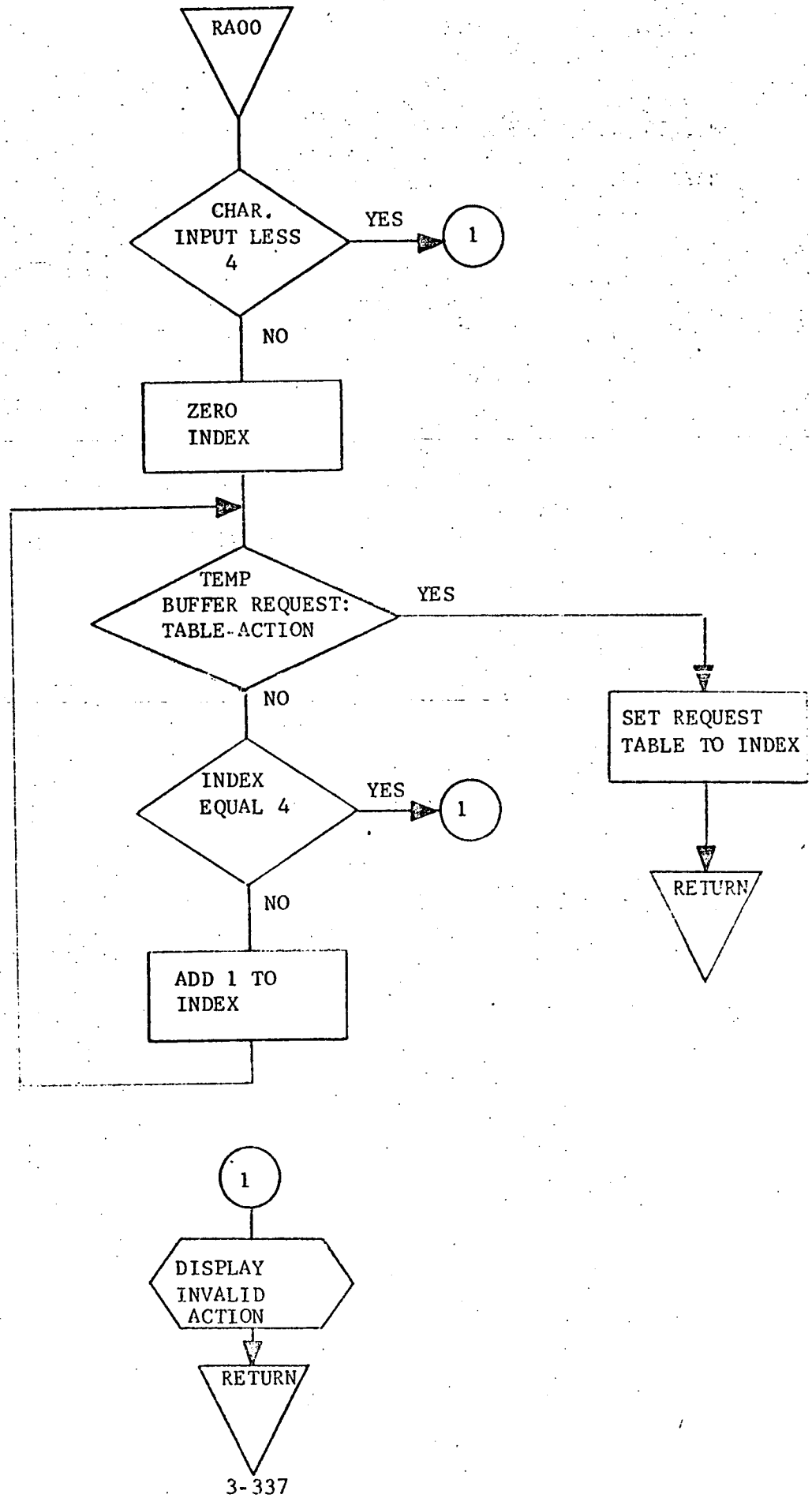
After the character count check is complete, the 3rd and 4th characters of the response are compared with the entries in the valid response table (RAPR). If a match is not found, the error message "INVALID ACTION" is displayed. If a match is found, an index equal to the relative position of the match entry in RAPR is placed in the sixth word of the Request Table for subsequent processing and control returned to CP00.

3.3.30.2.1 Calling Sequence

CALL RA00

REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	N/A	Modified
B	N/A	Same as Entry
X	N/A	Modified
Overflow	N/A	Same as Entry

3.3.30.2.2 General Flow Chart



3.3.30.3 Label Description

3.3.30.3.1 Local

RAPR is a five word table containing the following:

Word	Content	Meaning
0	'ST'	LIST
1	'PY'	COPY
2	'UN'	COUNT
3	'BU'	TABULATE
4	'AL'	ANALYZE

3.3.30.3.2 Global

None

3.3.30.3.3 Entry Point

RA00

3.3.30.3.4 External References

CPRT Request Table defined in CP00. The 6 word will be set as follows:

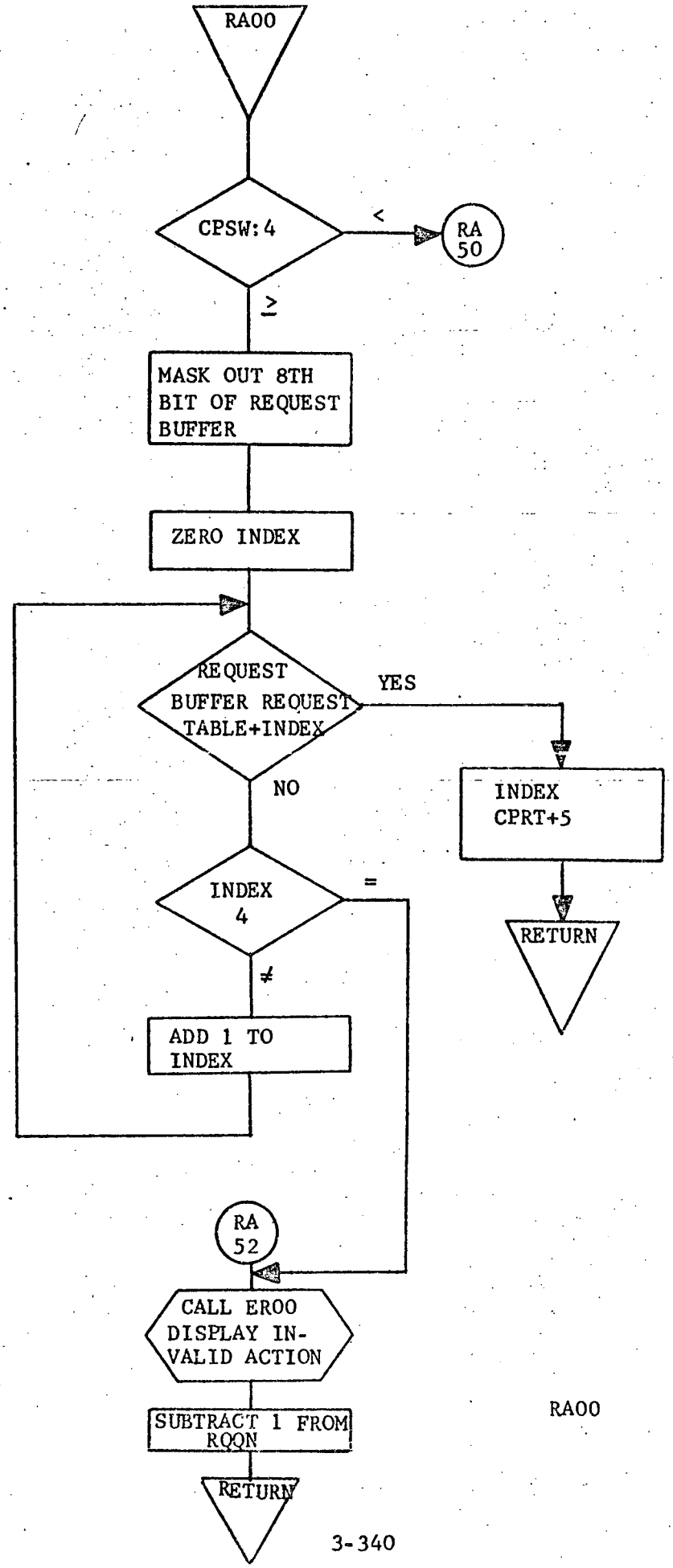
0	LIST
1	COPY
2	COUNT
3	TABULATE
4	ANALYZE

CPSW Status word found in CP00 containing number of characters input by user

3.3.30.3.4 External References (Continued)

ER00	Subroutine to output the error message
RQQN	Request question number defined in RQ00. On entry value, will be 5 and is changed to 4 only when error occurs.
RQTB	Request temporary buffer defined in RQ00
RQ37	Mask 7 bits of request defined in RQ00

3.3.30.4 Detailed Flow Chart



RA00

3.3.31 RC00 - Request Condition/What

3.3.31.1 Purpose

The purpose of this subroutine is to process the user's response to CONDITION and WHAT, and set the appropriate flags and pointers.

3.3.31.2 Technical Description

There are five legal parameters which can be input as responses to the CONDITION (WHAT) question. They are (1) left parenthesis, (2) right parenthesis, (3) operator (AND or OR), (4) operand, and (5) terminal. This subroutine has two major functions with respect to those parameters. First, it is to identify each parameter, passing on this information to BL00. Second, it is to store all operands in the Request Buffer. Associated with these two functions is the setting of flags and pointers and a limited amount of error checking.

To RC00 the user response is merely a string of characters packed two per word in the Temporary Input Buffer. A carriage return character is placed at the end to signify the end of the data. Between the beginning of the Buffer and this carriage return can be a complicated organization of the five legal parameters, making up a network of Boolean strings with up to ten operands.

There are certain rules that the parameters must follow:

(1) left parenthesis can follow operators or another left parenthesis.

(2) right parenthesis can follow operands or another right parenthesis

(3) operators must be preceded by and followed by a blank

(4) operands may be one of four forms:

a. heading alone

b. heading plus alpha answer

c. heading plus numeric answer

When an operand is placed in the Request Buffer, several pointers and flags must be set based on the following:

(1) The first word of the next available two word set in the Operand Buffer must be set to the beginning location of the operand in the Request Buffer.

(2) The next available location in the Condition (What) Table is a flag that describes the form of the operand. If the operand is of the form:

a. heading alone, the flag is zero

b. heading plus alpha answer, the flag is one and the location following the flag is an address which is the beginning location in the Request Buffer of the answer portion of the operand.

c. heading plus numeric answer, the flag is two and the location following the flag is an address which is the beginning location in the Request Buffer of the answer portion of the operand.

d. heading plus a range of numeric answer, the flag is three and the next two locations following the flag contain addresses which are the beginning locations in the Request Buffer of the lower limit and upper limit, respectively, of the range of numeric answer.

In the case when the WHAT response is being processed, there are a couple of special considerations. First, if the response is "ID ONLY" the ID flag, LIID, for LI00 routine is set. Secondly, if the ACTION response is Tabulate or Analyze, the number of operands is limited, based on the device to which the printed data is to be output. A check must be made with each parameter to verify that the maximum number of operands has not been exceeded. In addition, for Analyze, only numeric data can be specified in the What response.

3.3.31.2.1 Calling Sequence

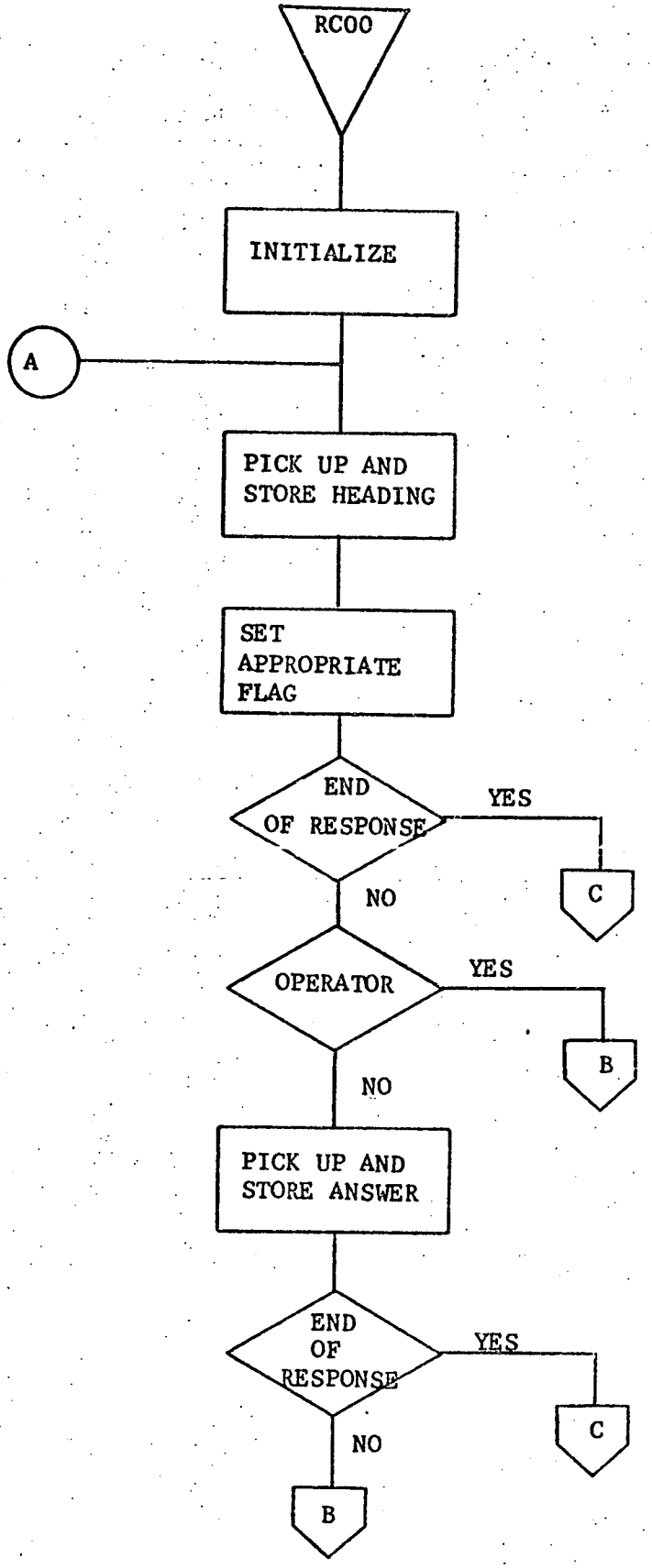
CALL RC00

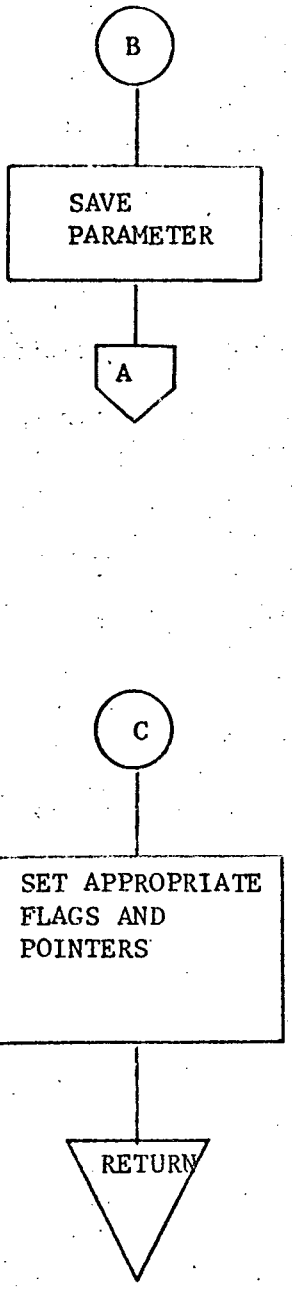
REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	N/A	N/A
B	N/A	N/A
X	N/A	N/A
Overflow	N/A	N/A

CALL OS00

REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	N/A	N/A
B	N/A	N/A
X	N/A	N/A
Overflow	N/A	N/A

3.3.31.2.2 General Flow Chart




B
SAVE
PARAMETER
A
C
SET APPROPRIATE
FLAGS AND
POINTERS
RETURN

3.3.31.3 Label Description

3.3.31.3.1 Local

RCBL (40_8) blank

RCCC character counter. Counts the number of characters processed so far in heading and/or answer portion of operand.

RCCH save location for character currently being processed.

RCCL (72_8) colon

RCCR (15_8) carriage return

RCCS colon switch. Flag that indicates a colon has been input and an answer must follow.

RCDT (10,5,5,5,5,2,2,2,2,9) device table. The maximum number of operands that can be analyzed or tabulated for each output device.

RCID (44504_8, 47516_8, 46131_8) "ID ONLY"

RCLP (50_8) left parenthesis

RCPA maximum number of operand parameters for current output device

RCPC location used to verify that an equal number of left parentheses and right parentheses are present. Incremented for left paren; decremented for right paren; zero at end of response if equal.

RCPM parameter code passed off to BL00 indicating the type of parameter currently being processed.

RCPX actual number of operand parameters.

RCRP (51_8) right parenthesis

RCSX save location for Request Buffer Pointer

3.3.31.3.1 Local (Continued)

RCTM (177_8) terminal character in Request Buffer

RCXX condition or What table pointer. Contains address of next available location or set of locations for flags and pointers associated with an operand.

3.3.31.3.2 Global

None

3.3.31.3.3 Entry Points

RCOO

3.3.31.3.4 External References

BLCO routine that builds the tree from the Boolean strings in the CONDITION response

CMOO routine that compares two sets of characters and returns equal to, greater than, or less than.

CPBB Bool Buffer

CPCT Condition Table

CPOB Operand Buffer

CPRB Request Buffer

CPRT Request Table

CPSW Status word from input. Equals number of characters input.

CPWT What Table

CPXB Bool Buffer pointer

CPXC Condition Table pointer

3.3.31.3.4 External References (Continued)

CPXO Operand Buffer pointer.

CPXR Request Buffer pointer

CPXW What Table pointer

ERO0 routine used to output a precoded error message to the primary output device

FILL routine to store a character or number in consecutive locations

LIID ID only flag. Indicates that the WHAT response was "ID ONLY."

OMDC output device code

OSBL table containing the characters stored in the Request Buffer by OS00

OS00 routine that searches the input stream for an operator ("AND or "OR")

PKBX buffer address for PK00

PKIX index used with PK00

PKSW switch indicating into which half of the word the next character is to be packed

PK00 routine that packs characters tow per word

RQQN request question number

RQTB Temporary Input Buffer

SI00 routine to clear stacks used by BL00

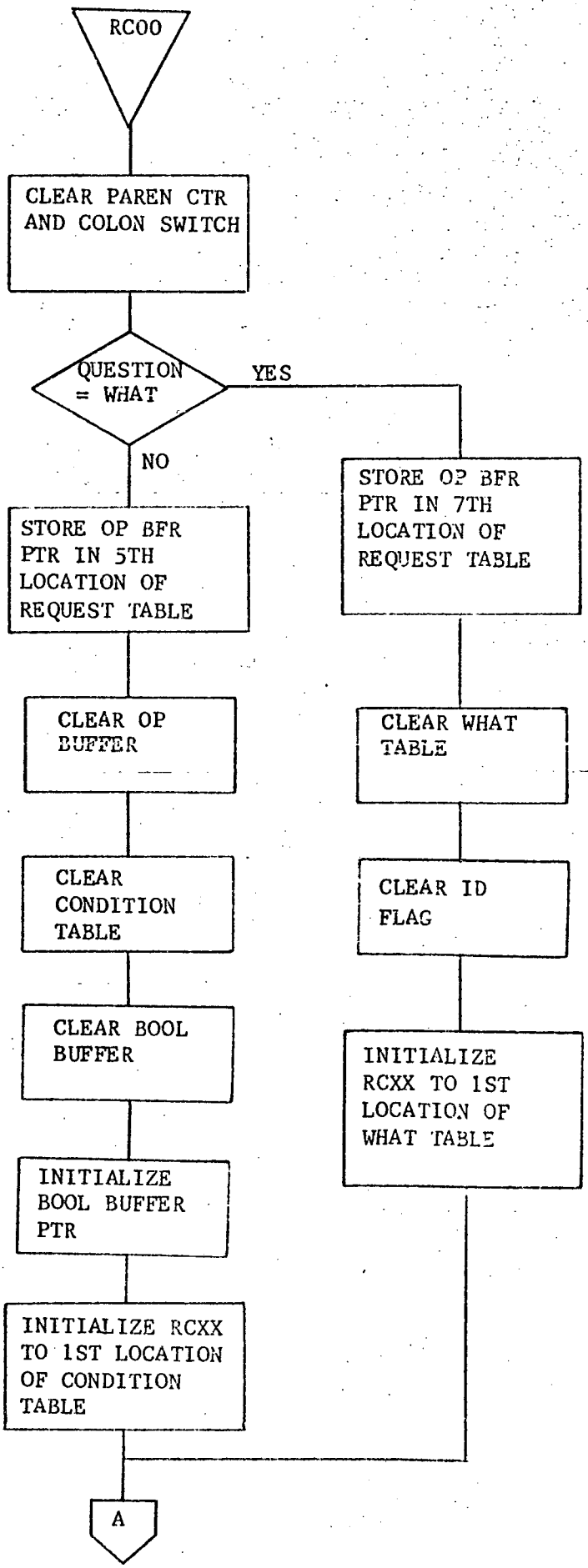
UPBX buffer address for UP00

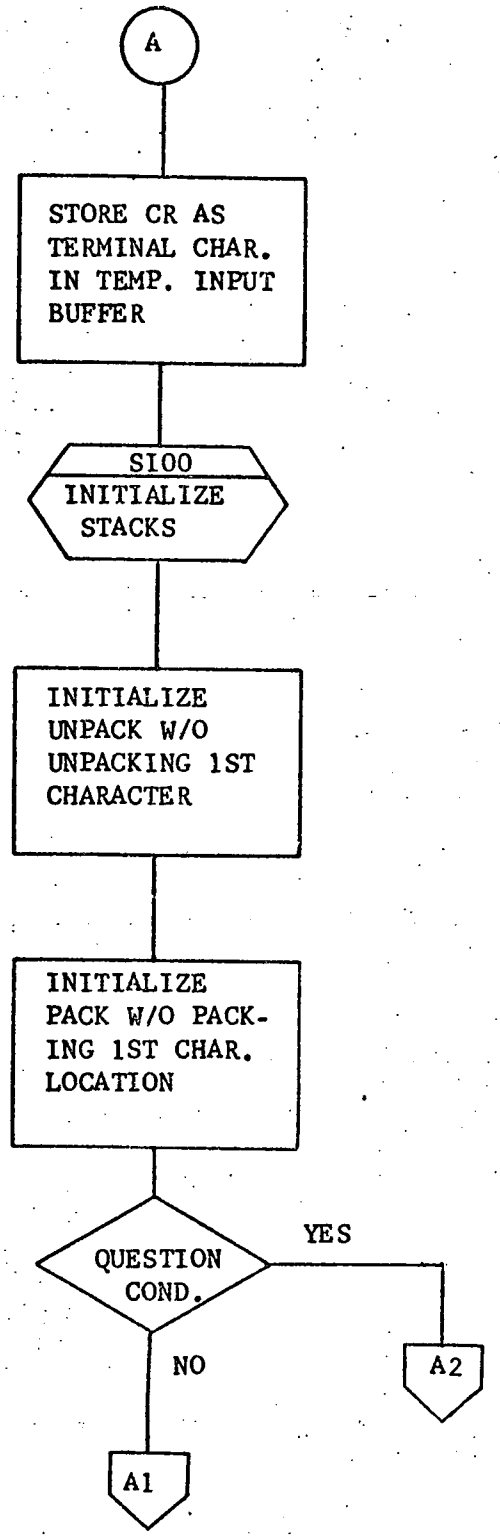
UPIX index used with UP00

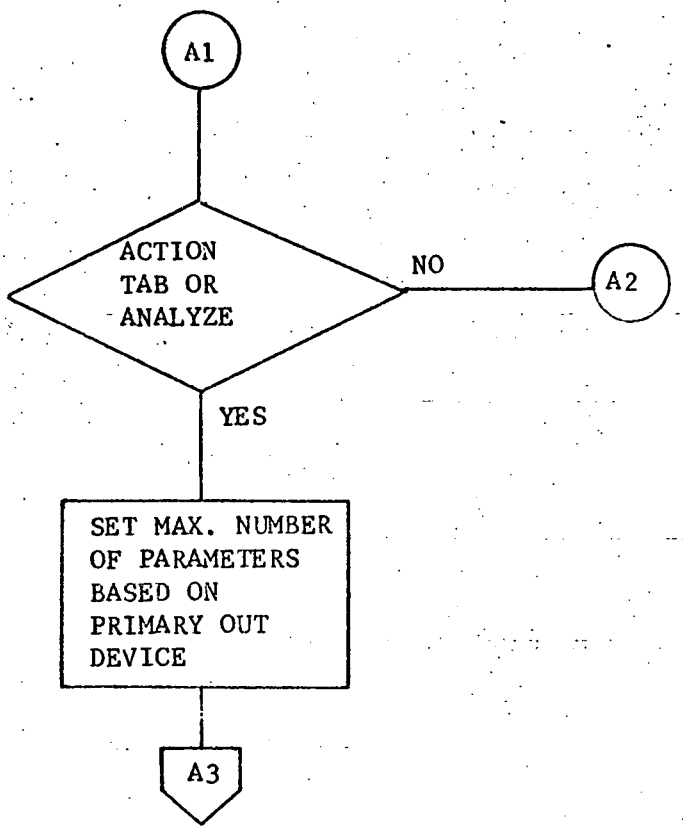
UPSW switch indicating which half of the word the next character is to be unpacked from

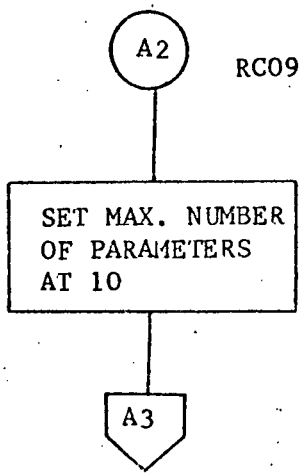
UP00 routine to unpack characters from a buffer

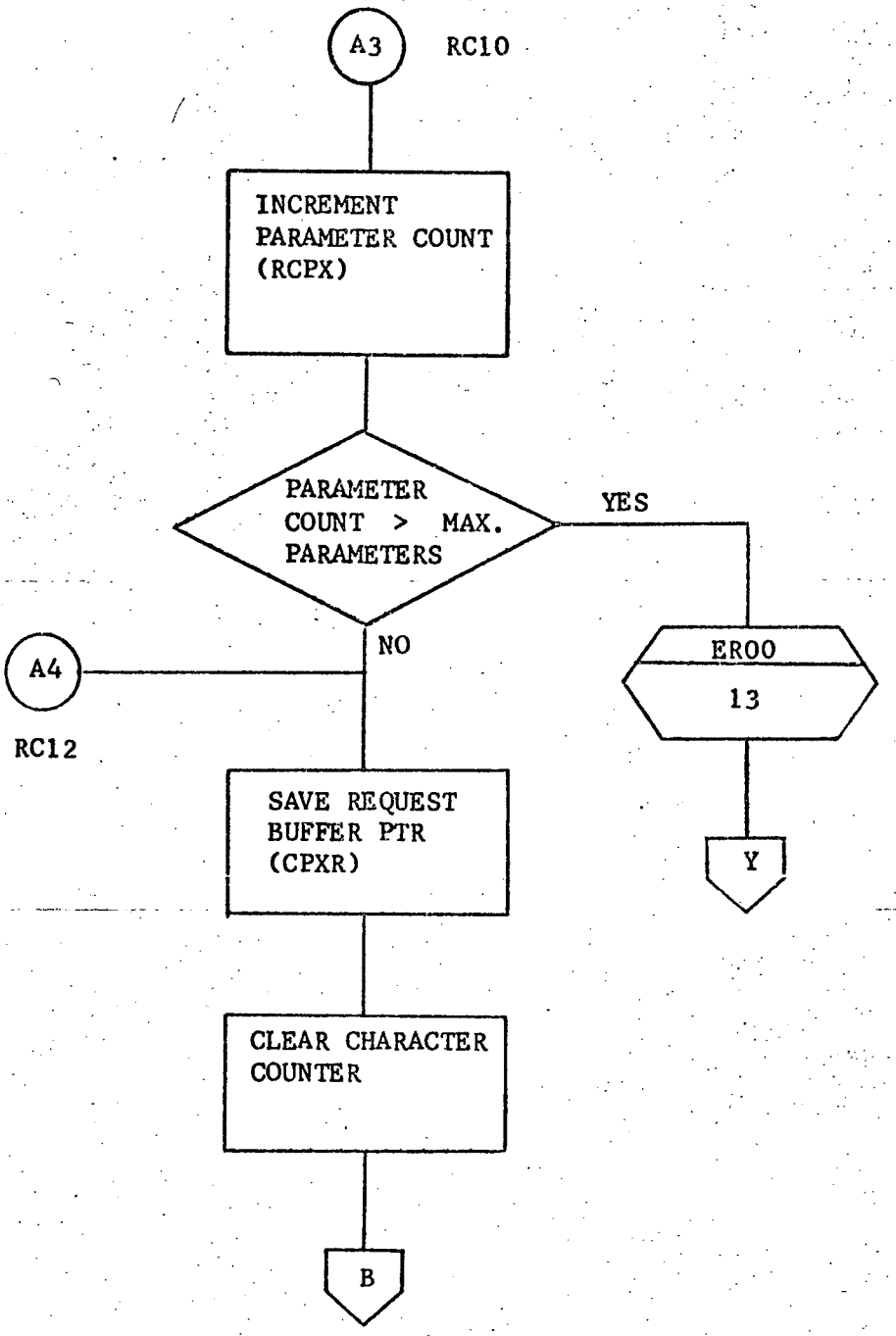
3.3.31.4 Detailed Flow Chart

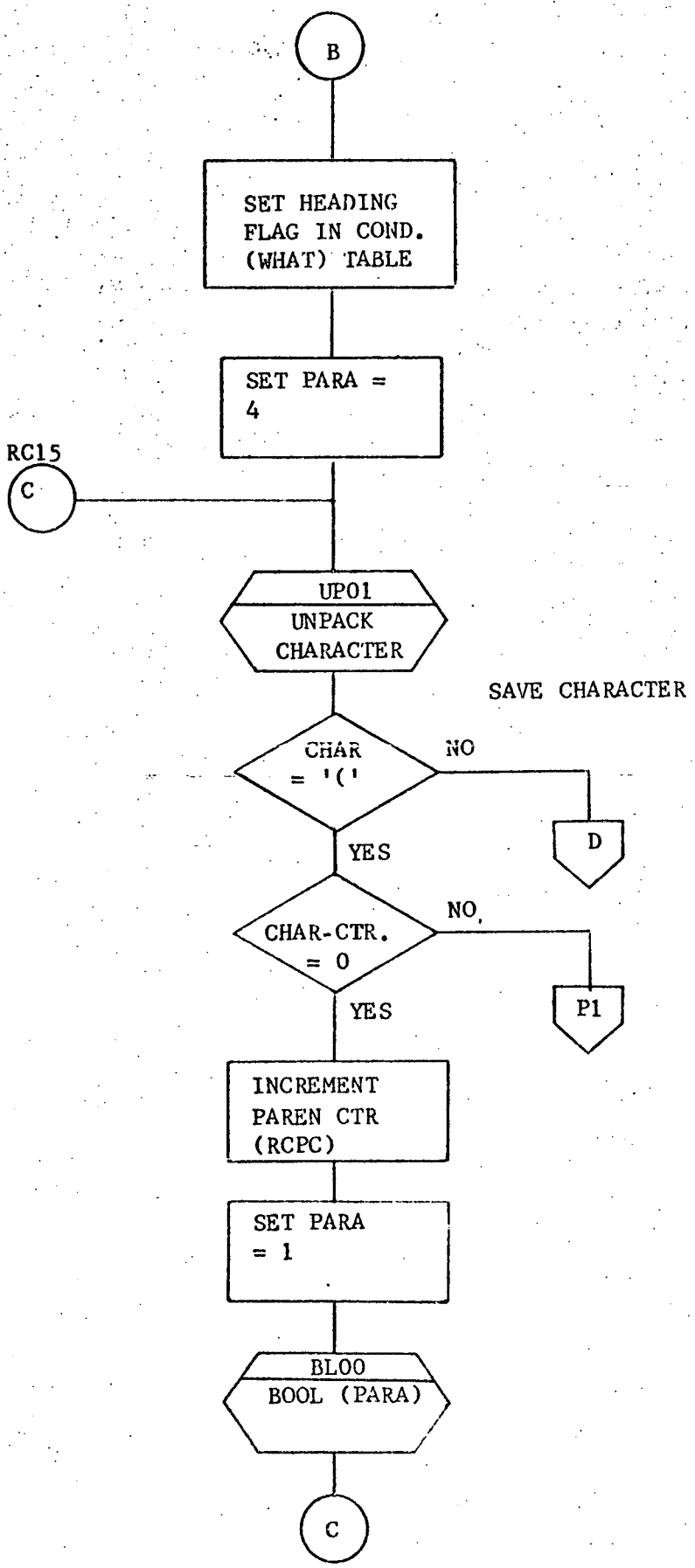


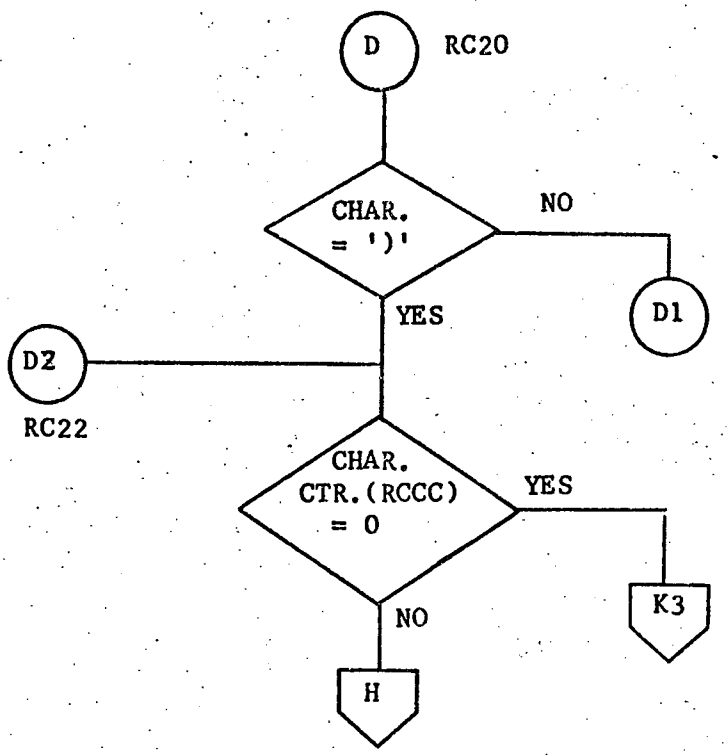

A
STORE CR AS TERMINAL CHAR. IN TEMP. INPUT BUFFER
SI00
INITIALIZE STACKS
INITIALIZE UNPACK W/O UNPACKING 1ST CHARACTER
INITIALIZE PACK W/O PACK-ING 1ST CHAR. LOCATION
QUESTION COND.
YES
NO
A2
A1

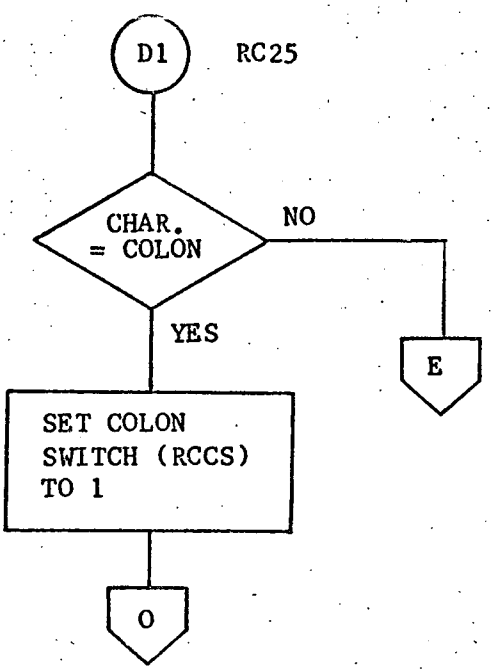

A1
ACTION TAB OR ANALYZE
NO
A2
YES
SET MAX. NUMBER OF PARAMETERS BASED ON PRIMARY OUT DEVICE
A3


A2
RC09
SET MAX. NUMBER OF PARAMETERS AT 10
A3

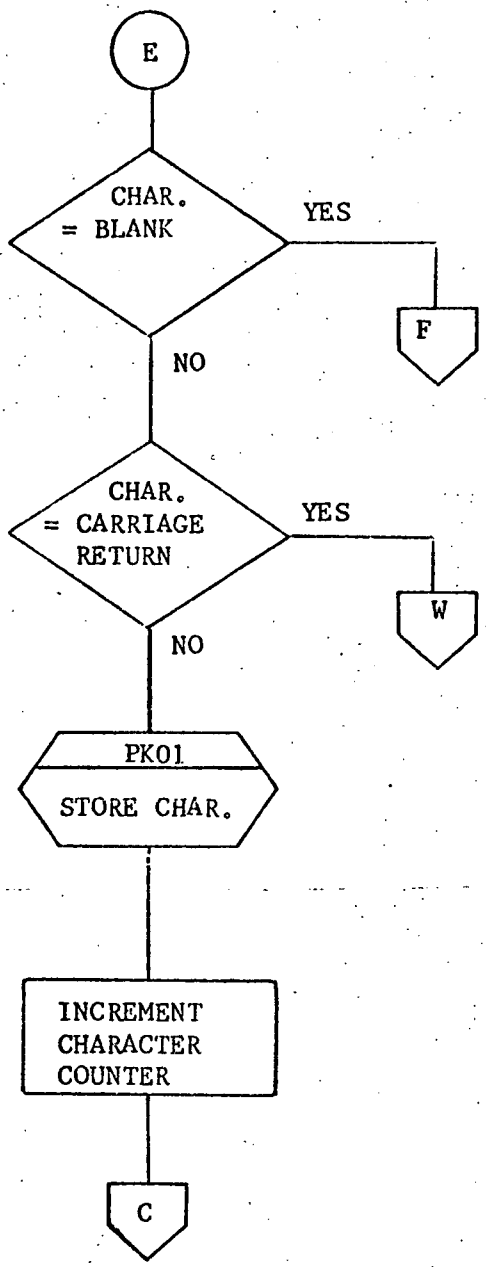

A3
RC10
INCREMENT PARAMETER COUNT (RCPX)
PARAMETER COUNT > MAX. PARAMETERS
YES
NO
A4
RC12
ER00
13
Y
SAVE REQUEST BUFFER PTR (CPXR)
CLEAR CHARACTER COUNTER
B

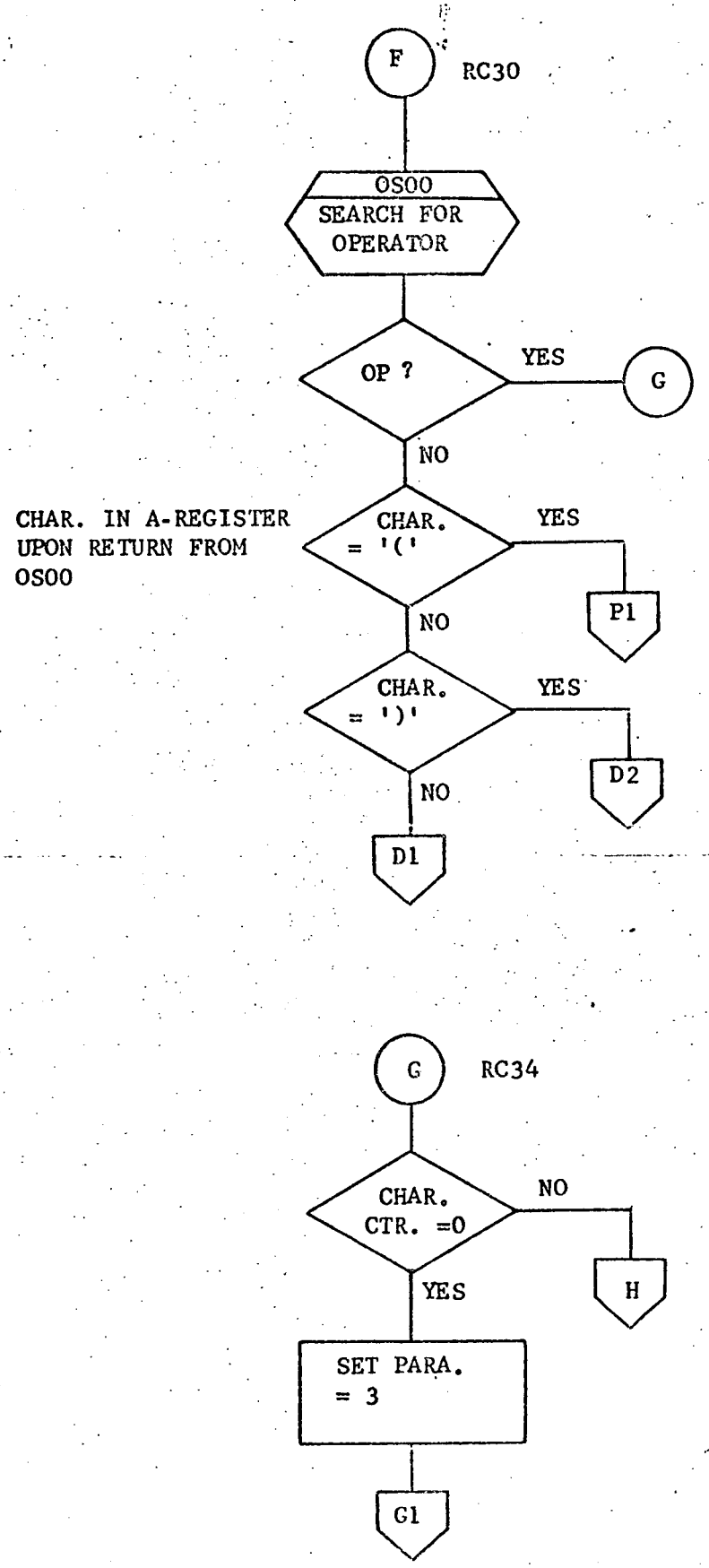

B
SET HEADING FLAG IN COND. (WHAT) TABLE
SET PARA = 4
RC15
C
UP01
UNPACK CHARACTER
SAVE CHARACTER
CHAR = '('
NO
D
YES
CHAR-CTR. = 0
NO
P1
YES
INCREMENT PAREN CTR (RCPC)
SET PARA = 1
BL00
BOOL (PARA)
C

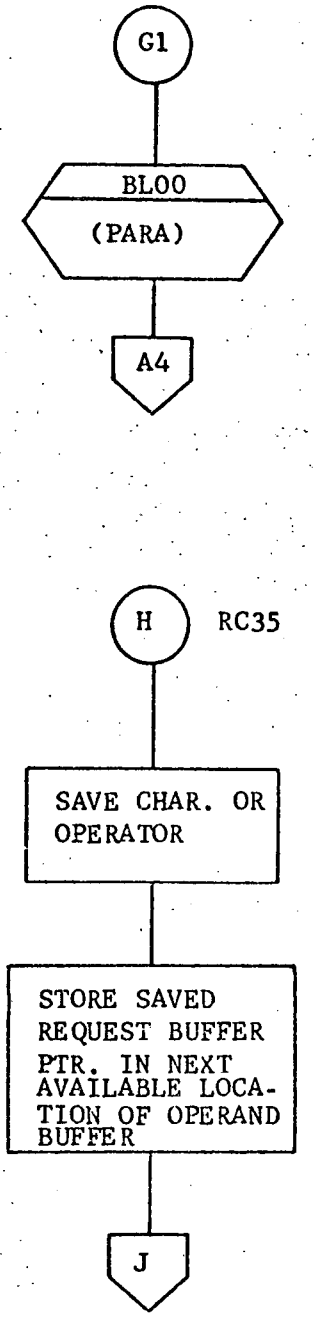

D
RC20
CHAR.
= ')'
NO
D1
YES
D2
RC22
CHAR.
CTR.(RCCC)
= 0
YES
K3
NO
H


D1
RC25
CHAR.
= COLON
NO
E
YES
SET COLON
SWITCH (RCCS)
TO 1
O

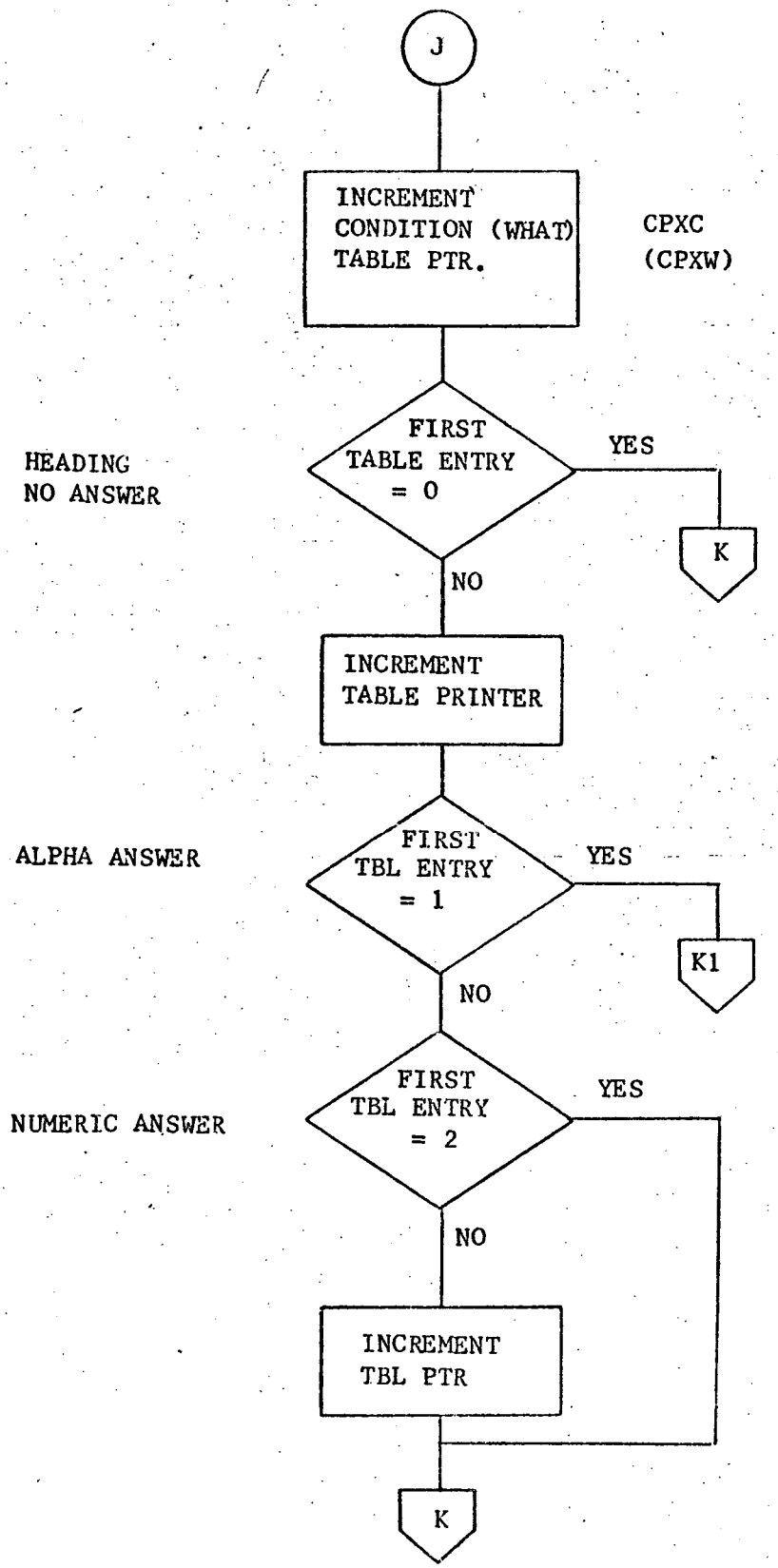
INPUT COMPLETE?

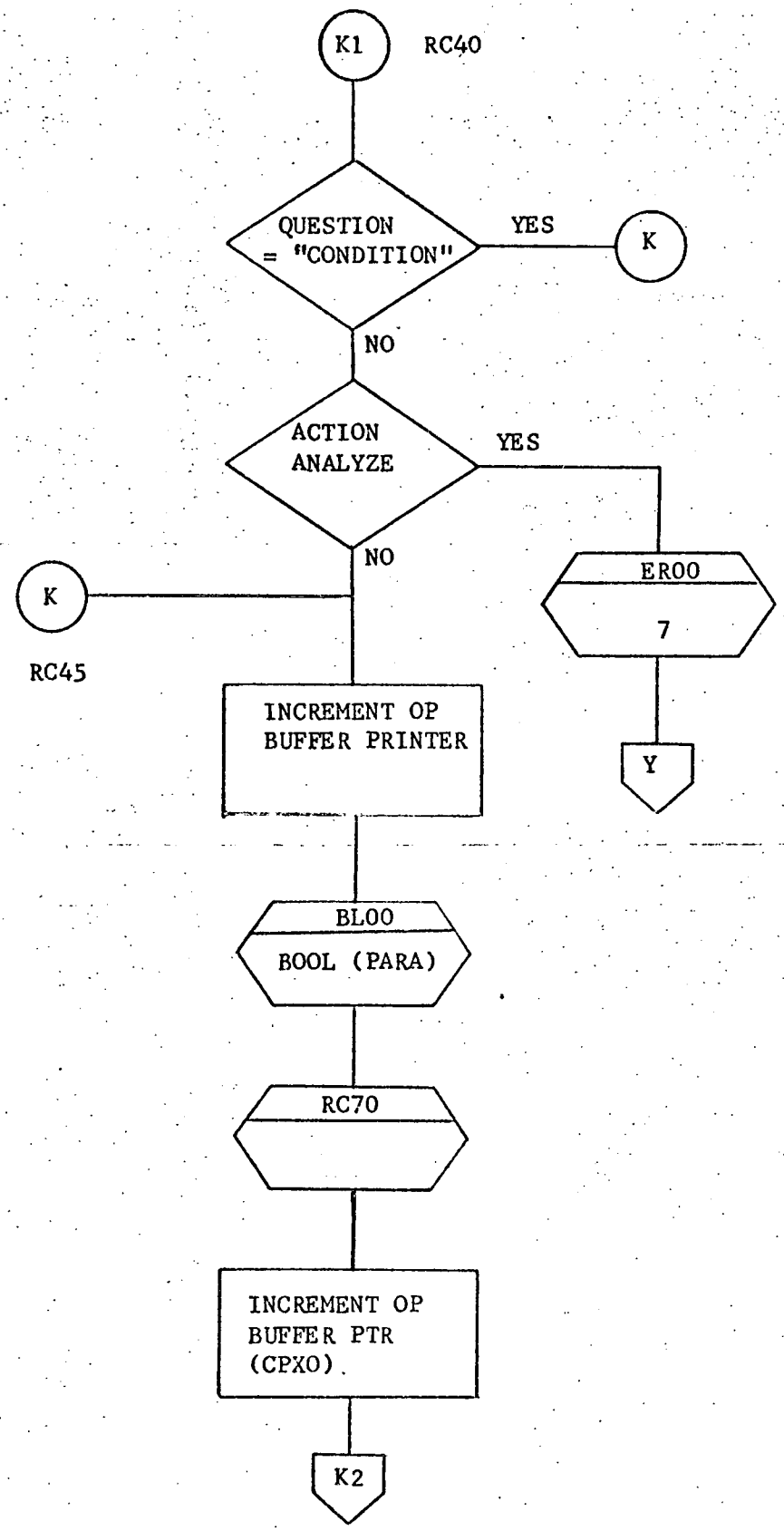


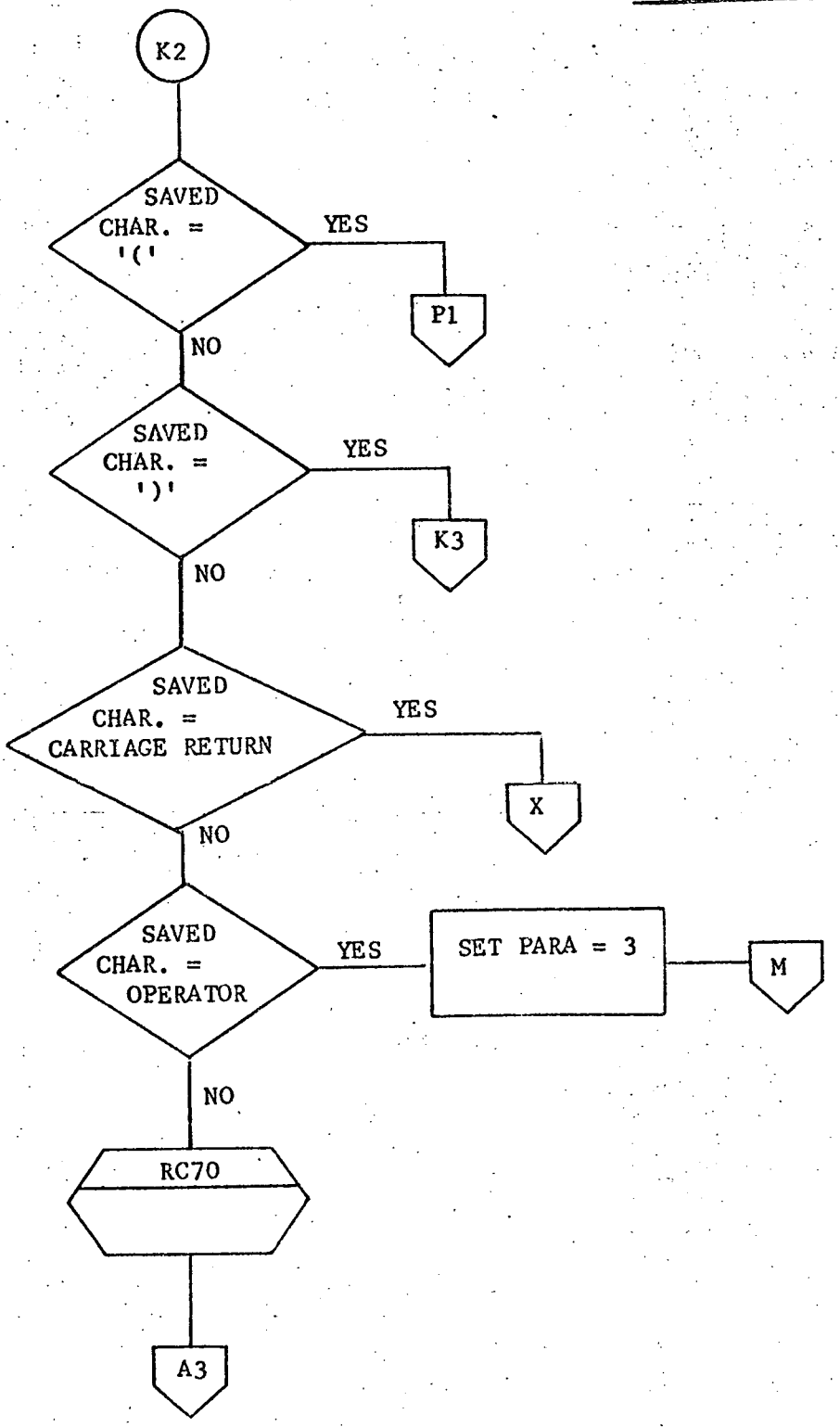

F
RC30
OS00
SEARCH FOR
OPERATOR
OP ?
YES
G
NO
CHAR. IN A-REGISTER
UPON RETURN FROM
OS00
CHAR.
= '('
YES
P1
NO
CHAR.
= ')'
YES
D2
NO
D1
G
RC34
CHAR.
CTR. =0
NO
H
YES
SET PARA.
= 3
G1

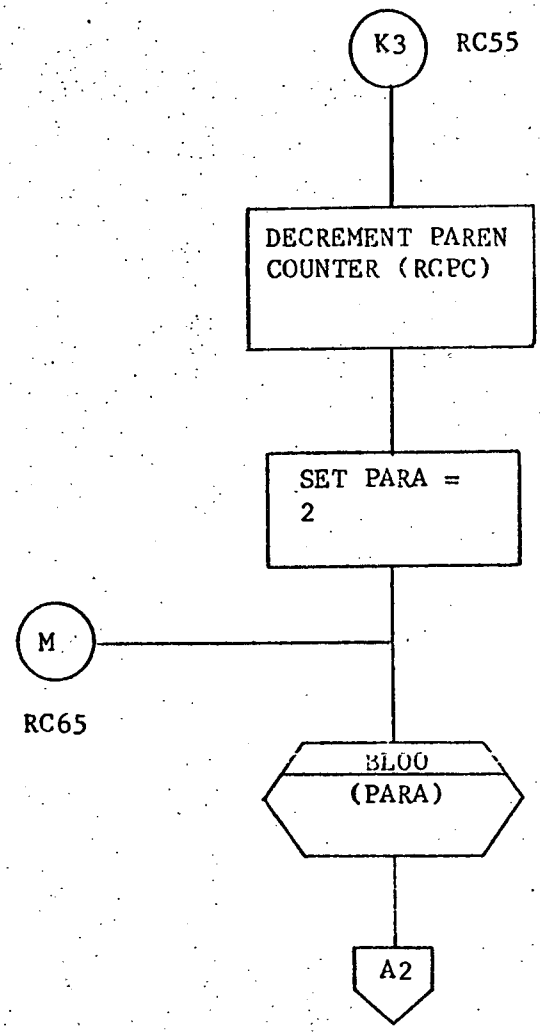


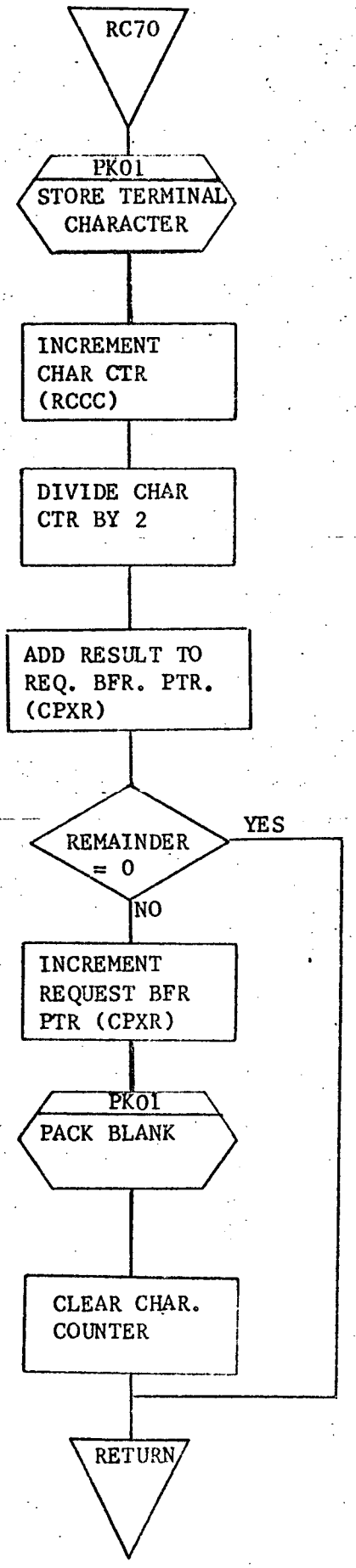
ALL PARAMETERS


J
INCREMENT CONDITION (WHAT) TABLE PTR.
CPXC (CPXW)
HEADING NO ANSWER
FIRST TABLE ENTRY = 0
YES
K
NO
INCREMENT TABLE PRINTER
ALPHA ANSWER
FIRST TBL ENTRY = 1
YES
K1
NO
NUMERIC ANSWER
FIRST TBL ENTRY = 2
YES
NO
INCREMENT TBL PTR
K

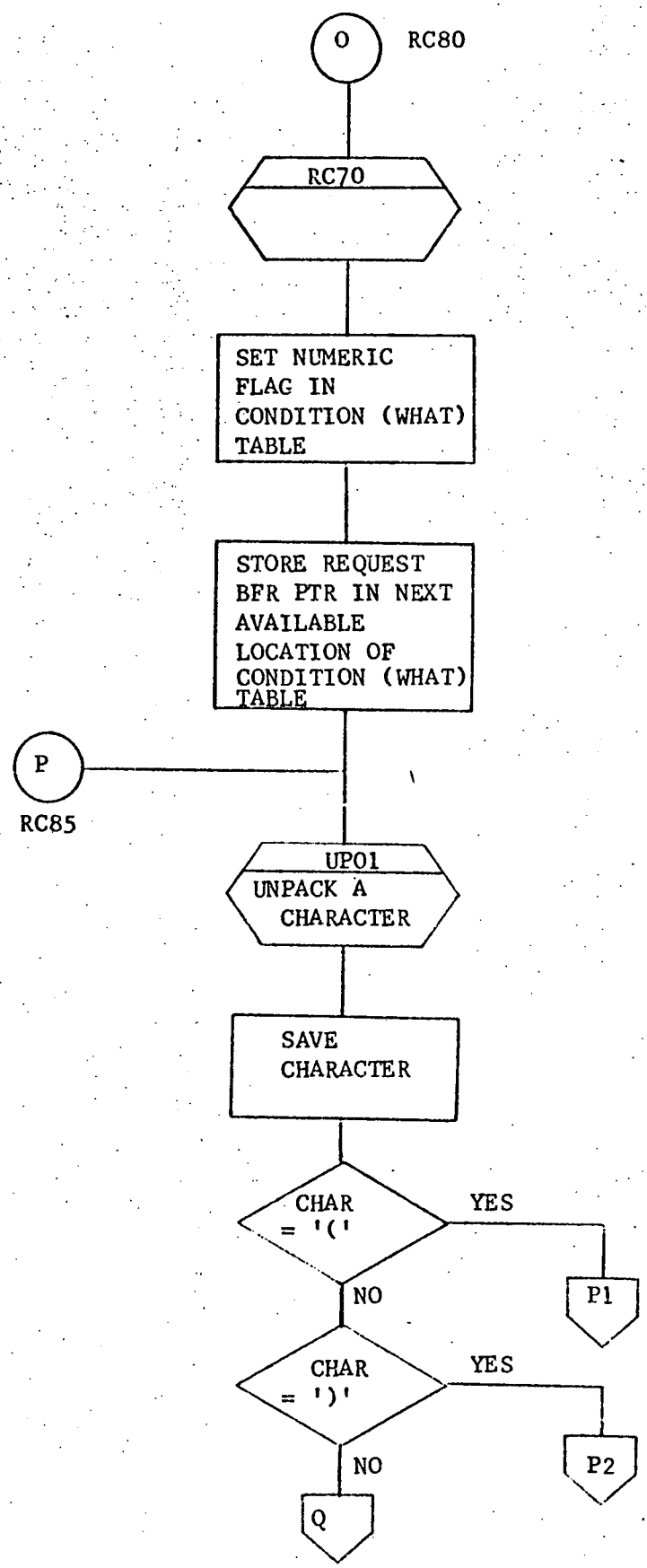

K1
RC40
QUESTION = "CONDITION"
YES
K
NO
ACTION ANALYZE
YES
NO
K
RC45
ER00
7
Y
INCREMENT OP BUFFER PRINTER
BL00
BOOL (PARA)
RC70
INCREMENT OP BUFFER PTR (CPXO).
K2


K2
SAVED CHAR. = '('
YES
P1
NO
SAVED CHAR. = ')'
YES
K3
NO
SAVED CHAR. = CARRIAGE RETURN
YES
X
NO
SAVED CHAR. = OPERATOR
YES
SET PARA = 3
M
NO
RC70
A3

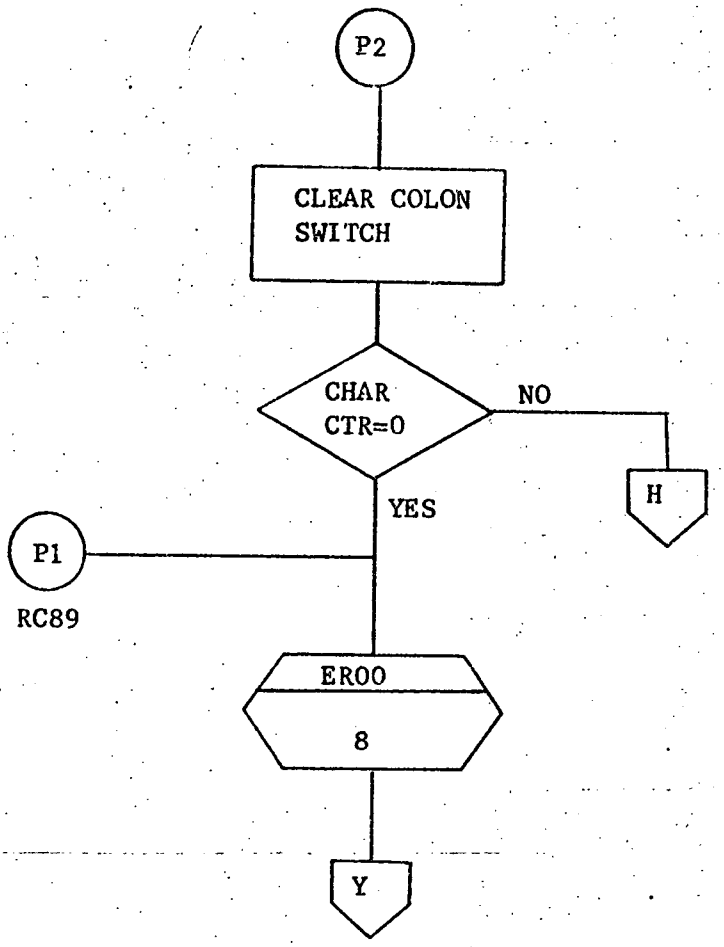

K3
RC55
DECREMENT PAREN COUNTER (RCPC)
SET PARA = 2
M
RC65
BLOO
(PARA)
A2


RC70
PK01
STORE TERMINAL CHARACTER
INCREMENT CHAR CTR (RCCC)
DIVIDE CHAR CTR BY 2
ADD RESULT TO REQ. BFR. PTR. (CPXR)
REMAINDER = 0
YES
NO
INCREMENT REQUEST BFR PTR (CPXR)
PK01
PACK BLANK
CLEAR CHAR. COUNTER
RETURN

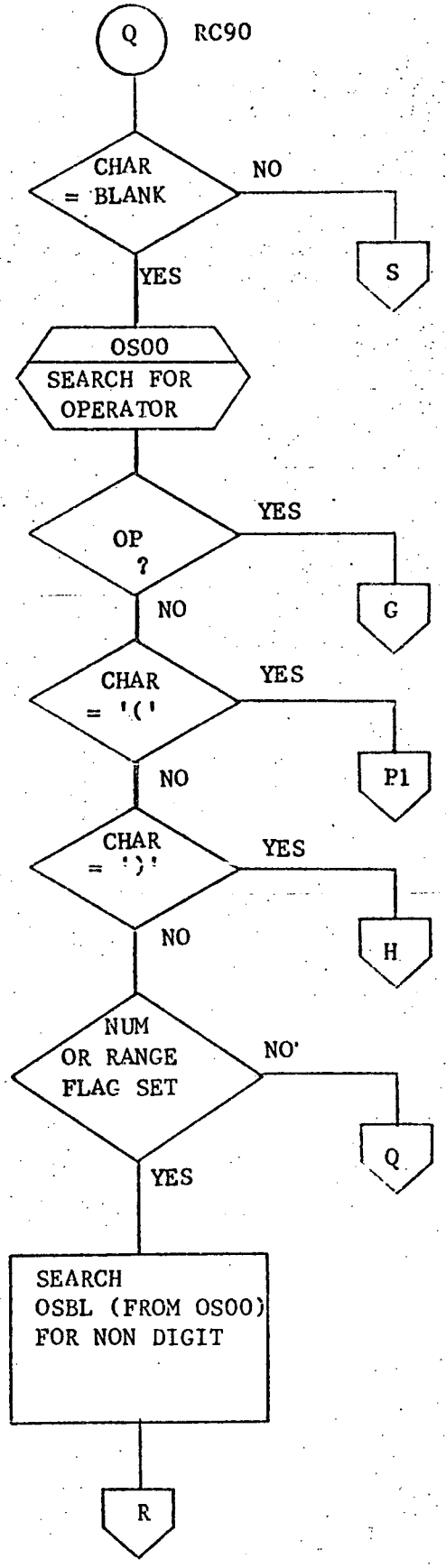
ANSWER


O
RC80
RC70
SET NUMERIC FLAG IN CONDITION (WHAT) TABLE
STORE REQUEST BFR PTR IN NEXT AVAILABLE LOCATION OF CONDITION (WHAT) TABLE
P
RC85
UP01
UNPACK A CHARACTER
SAVE CHARACTER
CHAR = '('
YES
NO
P1
CHAR = ')'
YES
NO
P2
Q

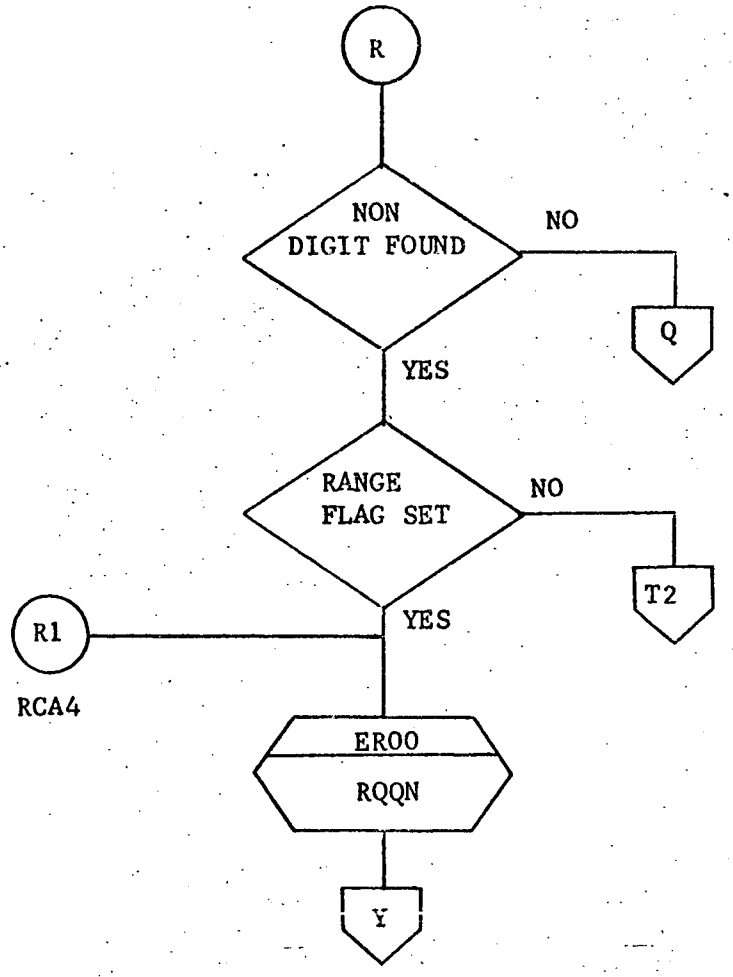
ANSWER

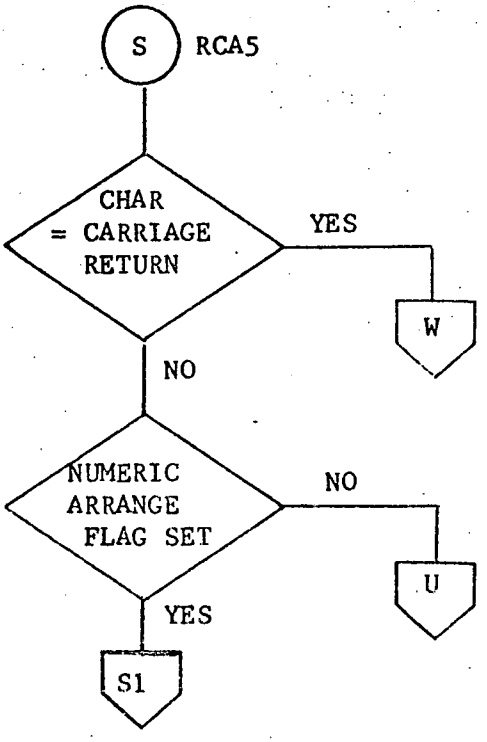


ANSWER

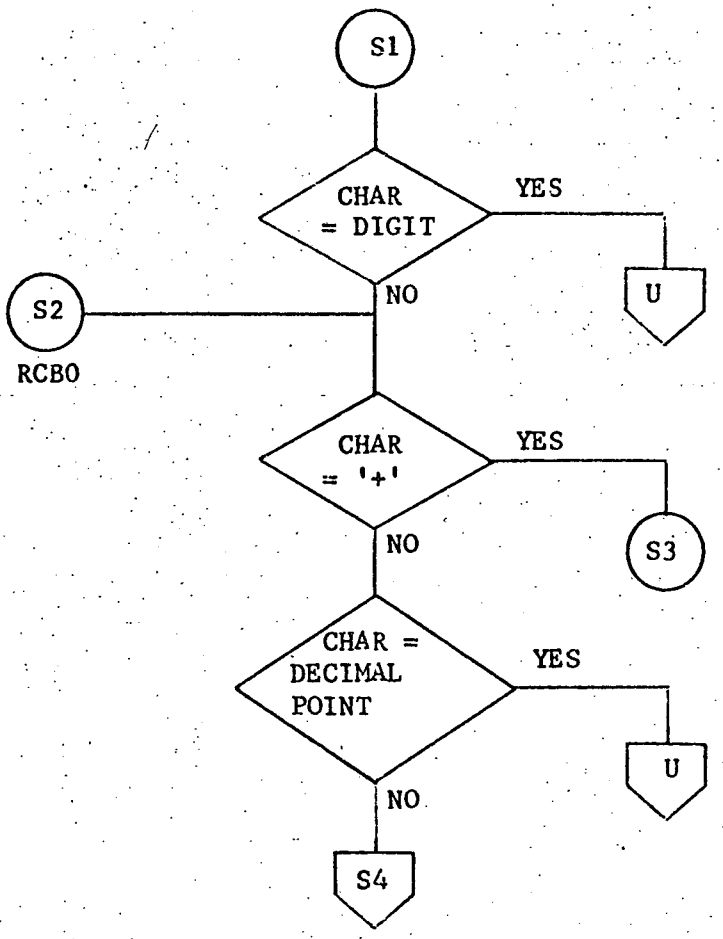

Q
RC90
CHAR = BLANK
NO
S
YES
OS00
SEARCH FOR OPERATOR
OP ?
YES
G
NO
CHAR = '('
YES
P1
NO
CHAR = ')'
YES
H
NO
NUM OR RANGE FLAG SET
NO'
Q
YES
SEARCH OSBL (FROM OS00) FOR NON DIGIT
R

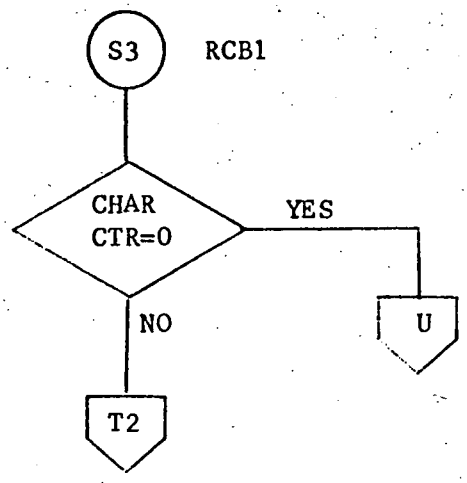
ANSWER


R
NON DIGIT FOUND
NO
Q
YES
RANGE FLAG SET
NO
T2
R1
YES
RCA4
ERO0
RQQN
Y

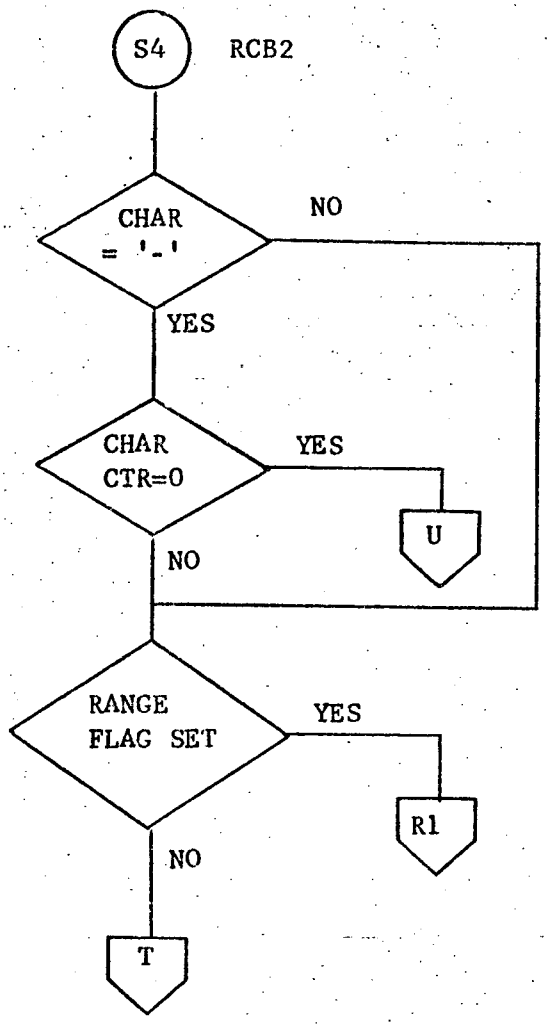

S
RCA5
CHAR = CARRIAGE RETURN
YES
W
NO
NUMERIC ARRANGE FLAG SET
NO
U
YES
S1

ANSWER

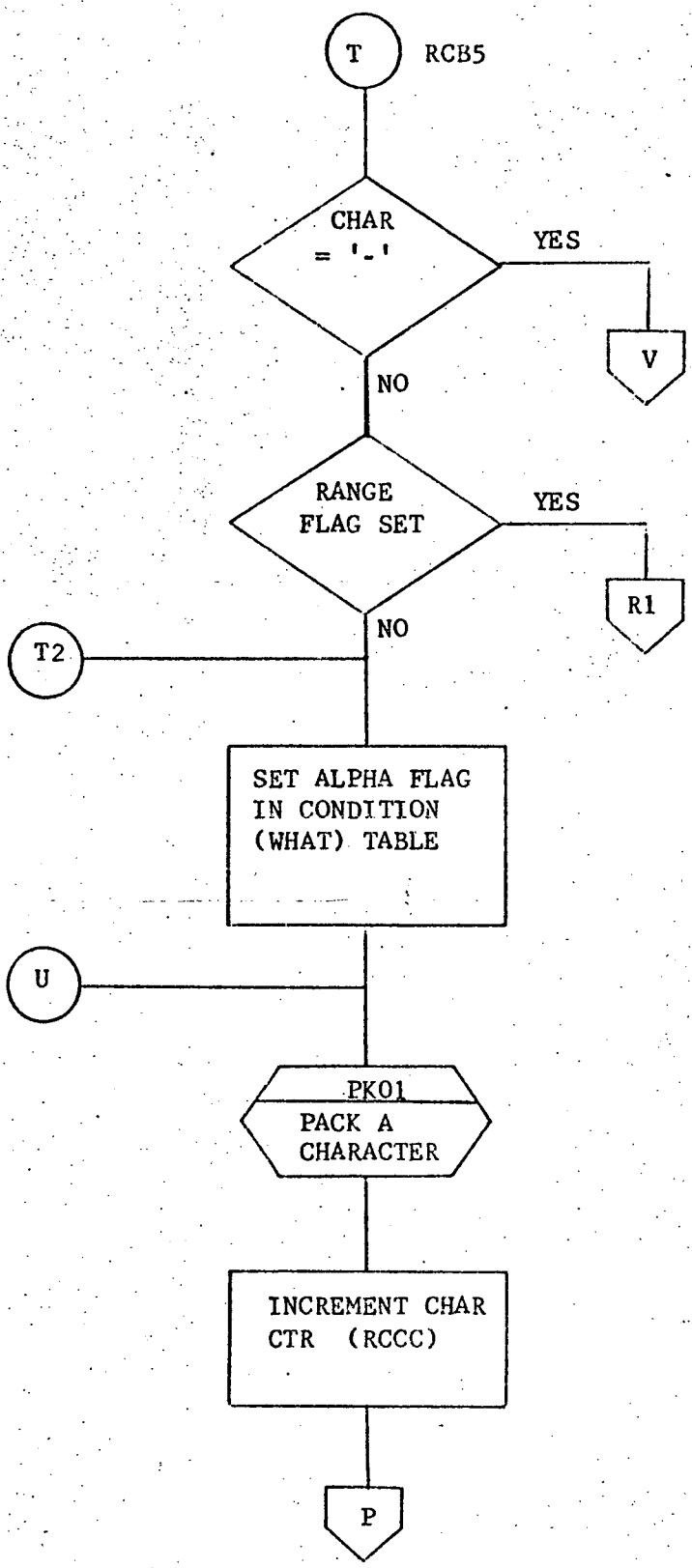

S1
CHAR
= DIGIT
YES
U
NO
S2
RCB0
CHAR
= '+'
YES
S3
NO
CHAR =
DECIMAL
POINT
YES
U
NO
S4


S3
RCB1
CHAR
CTR=0
YES
U
NO
T2

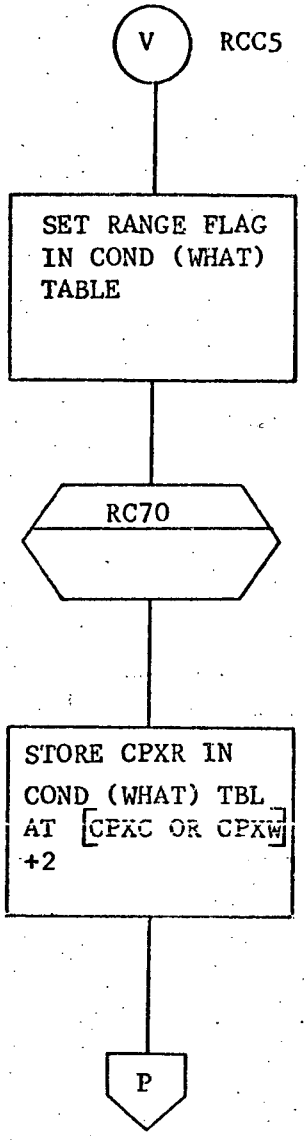
ANSWER

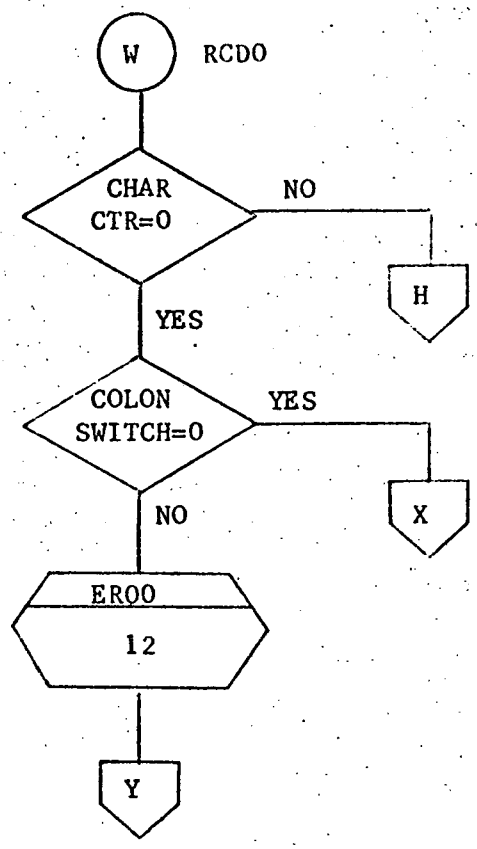


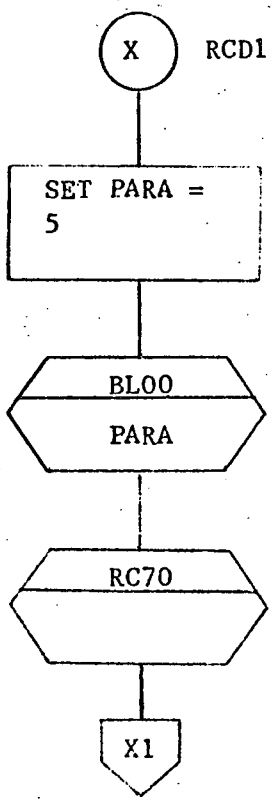
ANSWER

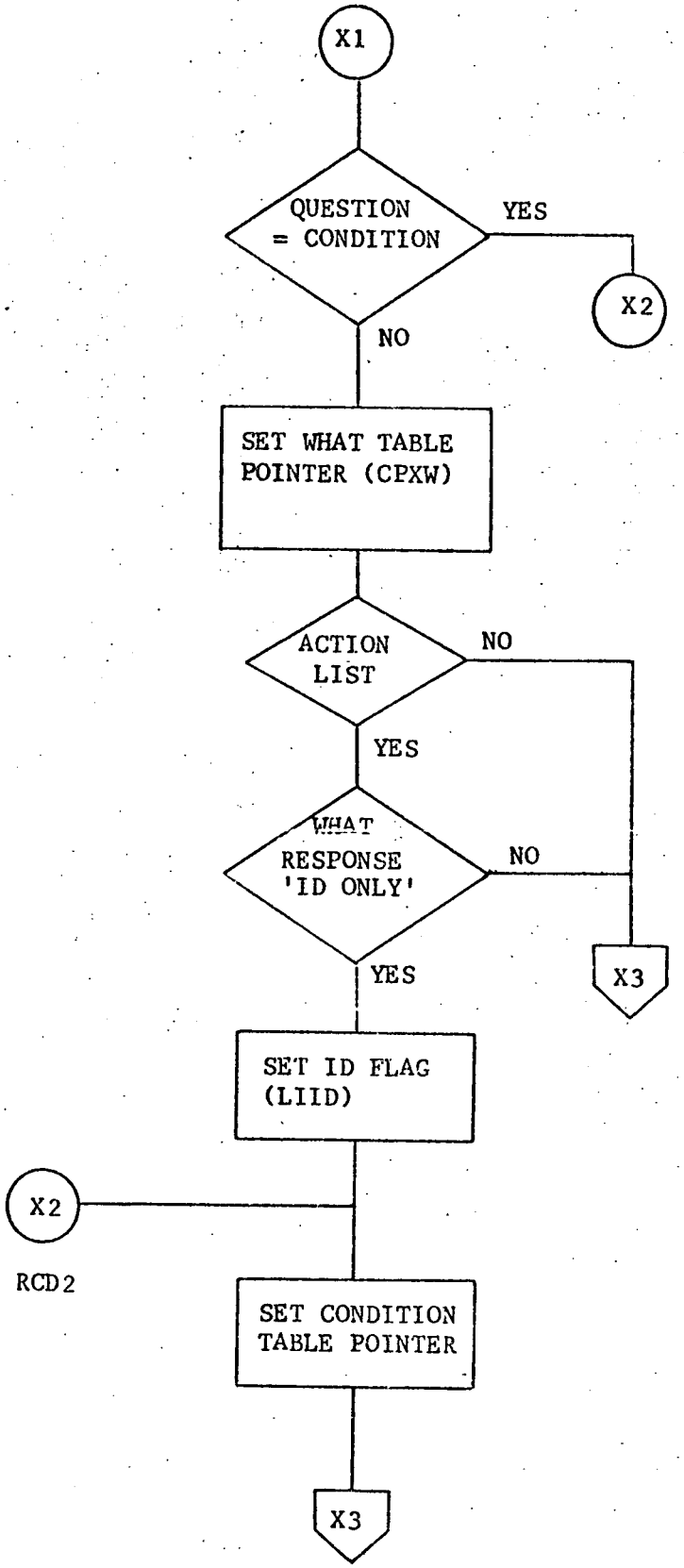

T
RCB5
CHAR
= '-'
YES
V
NO
RANGE
FLAG SET
YES
R1
NO
T2
SET ALPHA FLAG
IN CONDITION
(WHAT) TABLE
U
PK01
PACK A
CHARACTER
INCREMENT CHAR
CTR (RCCC)
P

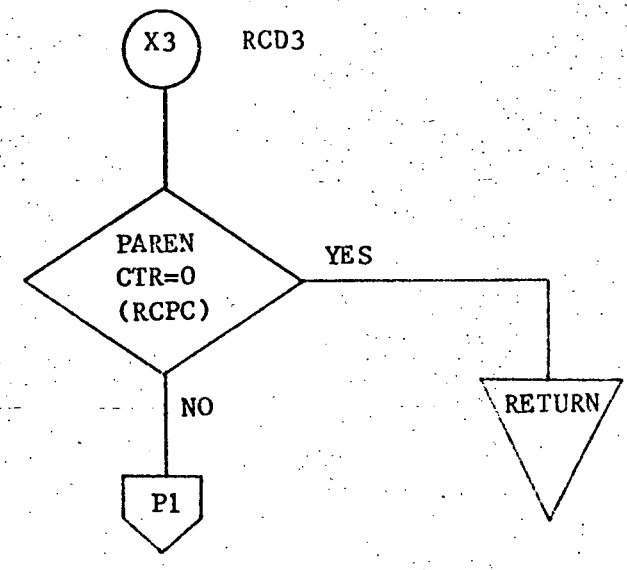
ANSWER

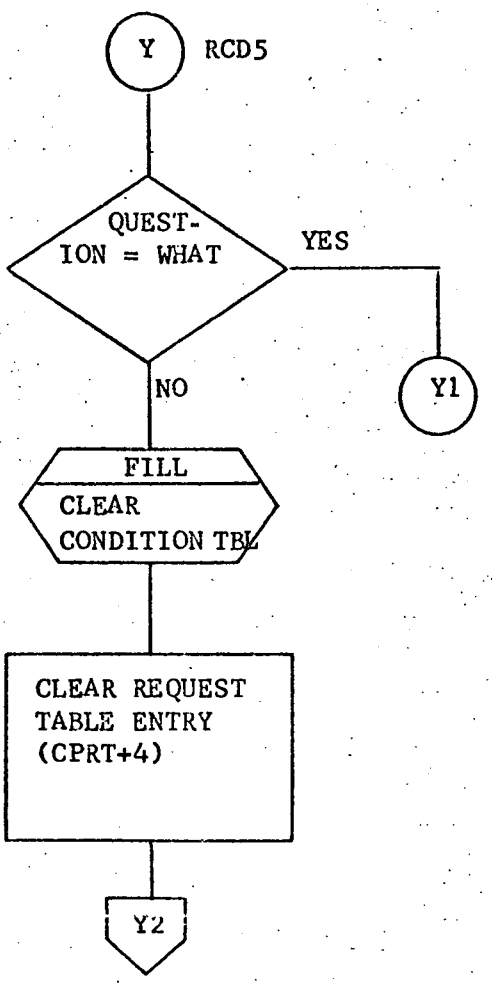

V
RCC5
SET RANGE FLAG IN COND (WHAT) TABLE
RC70
STORE CPXR IN COND (WHAT) TBL AT [CPXC OR CPXW] +2
P

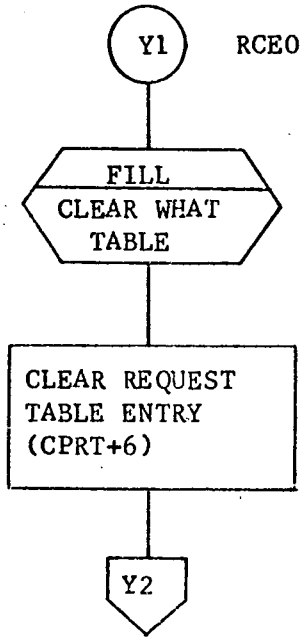

W
RCDO
CHAR CTR=0
NO
H
YES
COLON SWITCH=0
YES
X
NO
ERO0
12
Y

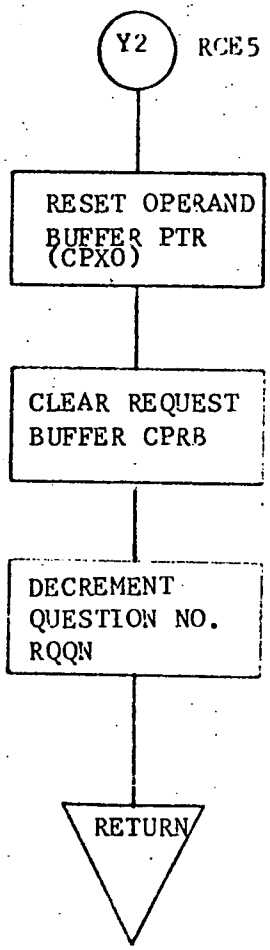

X
RCD1
SET PARA = 5
BLO0
PARA
RC70
X1

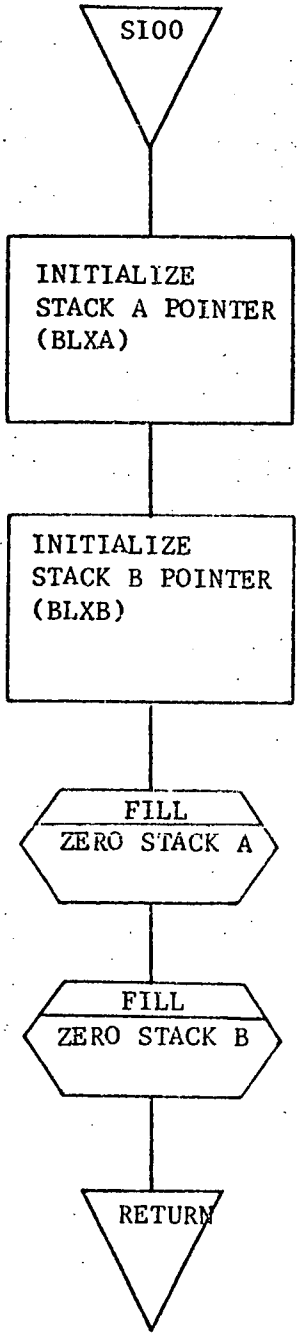

X1
QUESTION = CONDITION
YES
X2
NO
SET WHAT TABLE POINTER (CPXW)
ACTION LIST
NO
YES
WHAT RESPONSE 'ID ONLY'
NO
X3
YES
SET ID FLAG (LIID)
X2
RCD2
SET CONDITION TABLE POINTER
X3


X3
RCD3
PAREN
CTR=0
(RCPC)
YES
NO
RETURN
P1


Y
RCD5
QUEST-
ION = WHAT
YES
NO
Y1
FILL
CLEAR
CONDITION TBL
CLEAR REQUEST
TABLE ENTRY
(CPRT+4)
Y2


Y1
RCE0
FILL
CLEAR WHAT
TABLE
CLEAR REQUEST
TABLE ENTRY
(CPRT+6)
Y2


Y2
RCE5
RESET OPERAND BUFFER PTR (CPX0)
CLEAR REQUEST BUFFER CPRB
DECREMENT QUESTION NO. RQQN
RETURN


SI00
INITIALIZE
STACK A POINTER
(BLXA)
INITIALIZE
STACK B POINTER
(BLXB)
FILL
ZERO STACK A
FILL
ZERO STACK B
RETURN

3.3.32 RD00 - Request Date

3.3.32.1 Purpose

RD00 is a subroutine whose purpose is to process the user response for the date portion of the user request criteria.

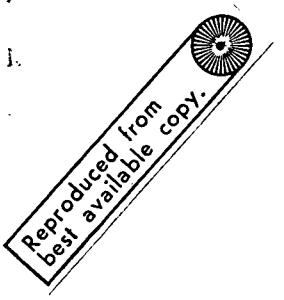
3.3.32.2 Technical Description

After the "DATE" question is output, the user inputs his response to the question. The answer is moved character by character into a Temporary Input Buffer. RD00 first picks up the day representation from the Temporary Input Buffer. If the day portion of the response is not numeric, less than one, or greater than thirty-one, it is ruled invalid, an error message is sent to the user and control is passed to the calling program. If the day is valid, it is packed into the Request Buffer. The same procedure is followed for the month and year entries. Valid entries are stored in the Request Buffer and invalid entries cause an exit with an appropriate error message. Note, however, that the month is stored in binary and not alphabetic form, i.e., January is stored as 01, February is 02, etc. The only exception to this rule are the months October, November, and December, which are represented as 13, 14, and 15 which is necessary for MEDATA compatibility. If a date range is requested (for example, 05Jan71-10Mar71) both dates are processed in the same fashion and a flag pointing to the beginning address of the second date in the Request Buffer is set.

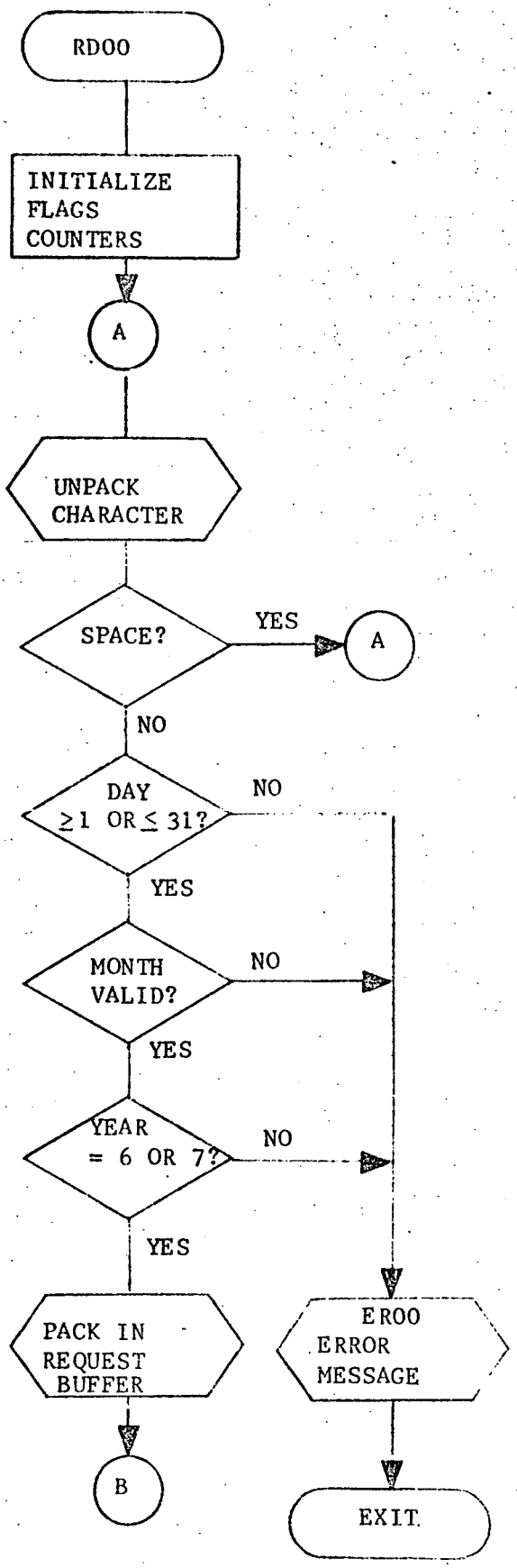
3.3.32.2.1 Calling Sequenc

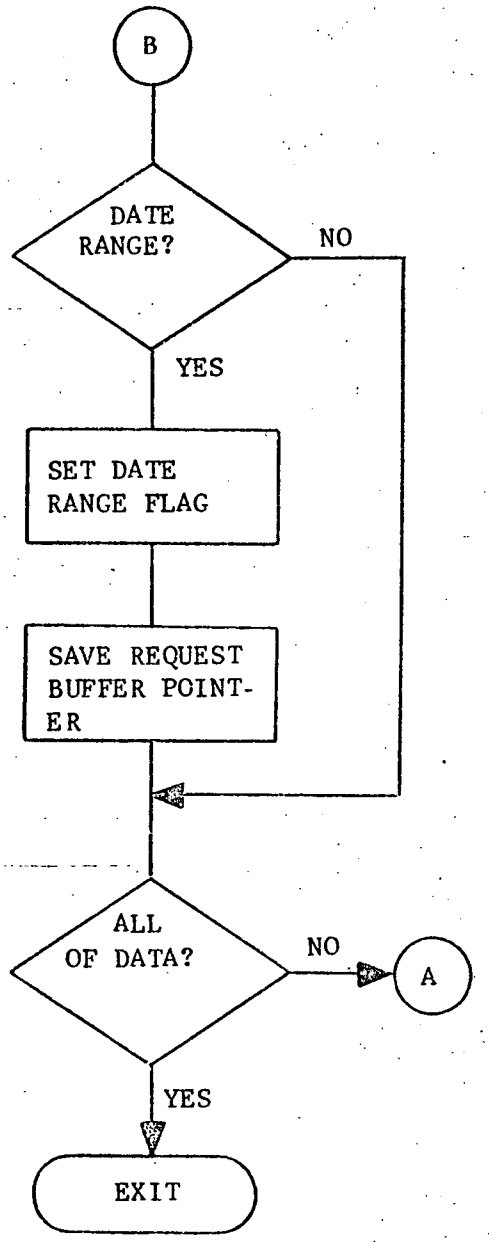
CALL RDOO

REGISTER	CONT	TS UPON EXIT
A		ictable
B		ictable
X		ictable
Overflow		N/A



3.3.32.2.2 General Flow Chart




B
DATE RANGE?
NO
YES
SET DATE RANGE FLAG
SAVE REQUEST BUFFER POINT-ER
ALL OF DATA?
NO
A
YES
EXIT

3.3.32.3 Label Description

3.3.32.3.1 Local

RDCT - storage location used to keep count of how many data characters have been processed.

RDDF - storage location which is set (incremented) upon detecting a range of dates as a user response.

RDMK - (value 177) storage location containing the sentinel character which follows the data.

RDMT - starting address of the twelve word date table. This table is used during the month validation processing.

3.3.32.3.2 Global

N/A

3.3.32.3.3 Entry Points

RDOO - primary entry point

3.3.32.3.4 External References

3.3.32.3.4.1 External Labels

CPRT - starting address of the Request Table

CPSW - storage location containing the number of data characters input

CPXR - storage location for the request buffer pointer

RQQN - storage location for the question number index

RQTB - starting address of the Temporary Input Buffer

3.3.32.3.4.2 External Subroutines

EROO - output error message routine

PKOO - pack character routine

UPOO - unpack character routine

3.3.32.3.3 Entry Points

RD00 - primary entry point

3.3.32.3.4 External References

3.3.32.3.4.1 External Labels

CPRT - starting address of the Request Table

CPSW - storage location containing the number of data characters input

CPXR - storage location for the request buffer pointer

RQQN - storage location for the question number index

RQTB - starting address of the Temporary Input Buffer

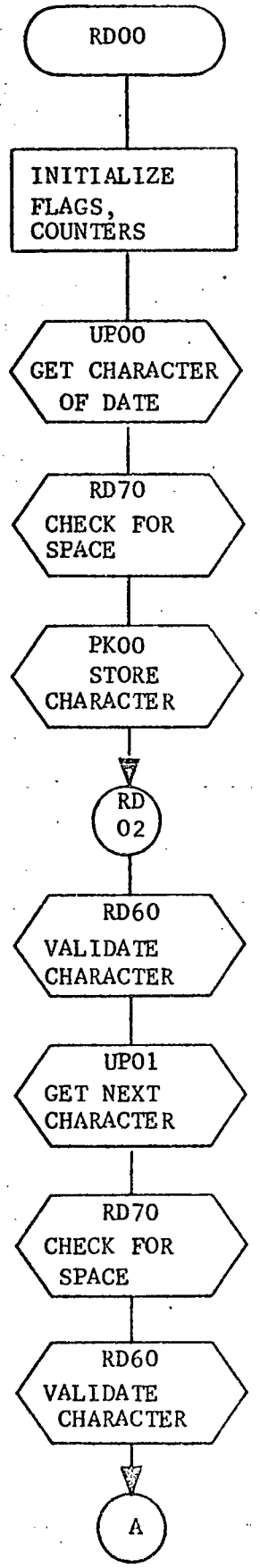
3.3.32.3.4.2 External Subroutines

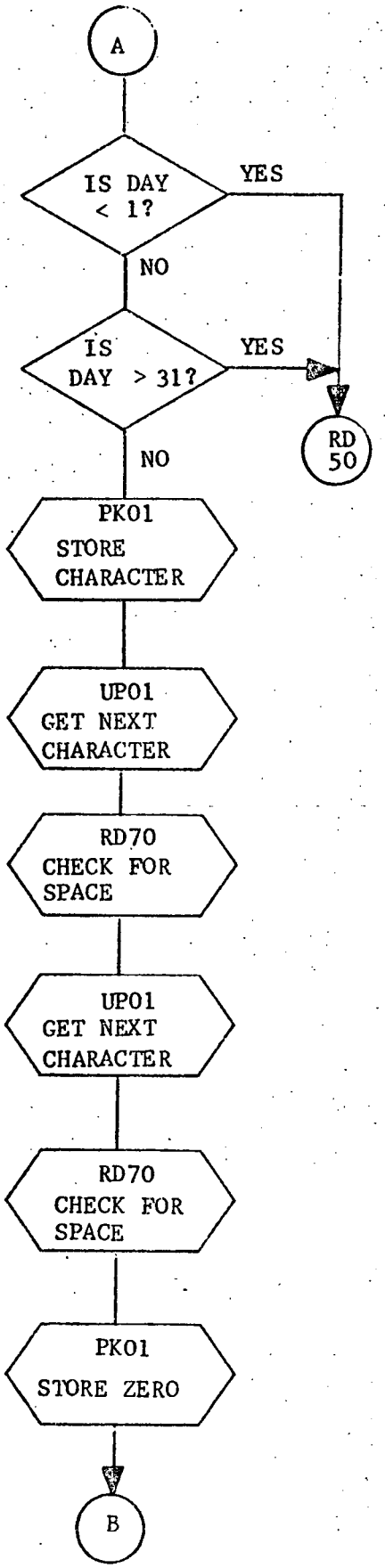
ER00 - output error message routine

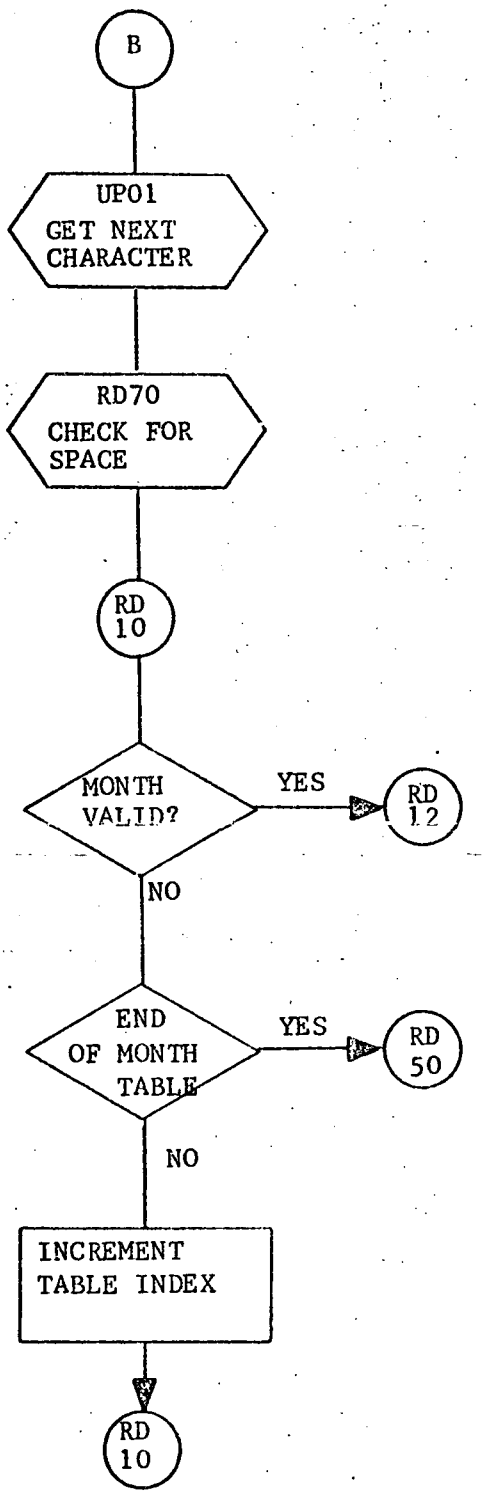
PK00 - pack character routine

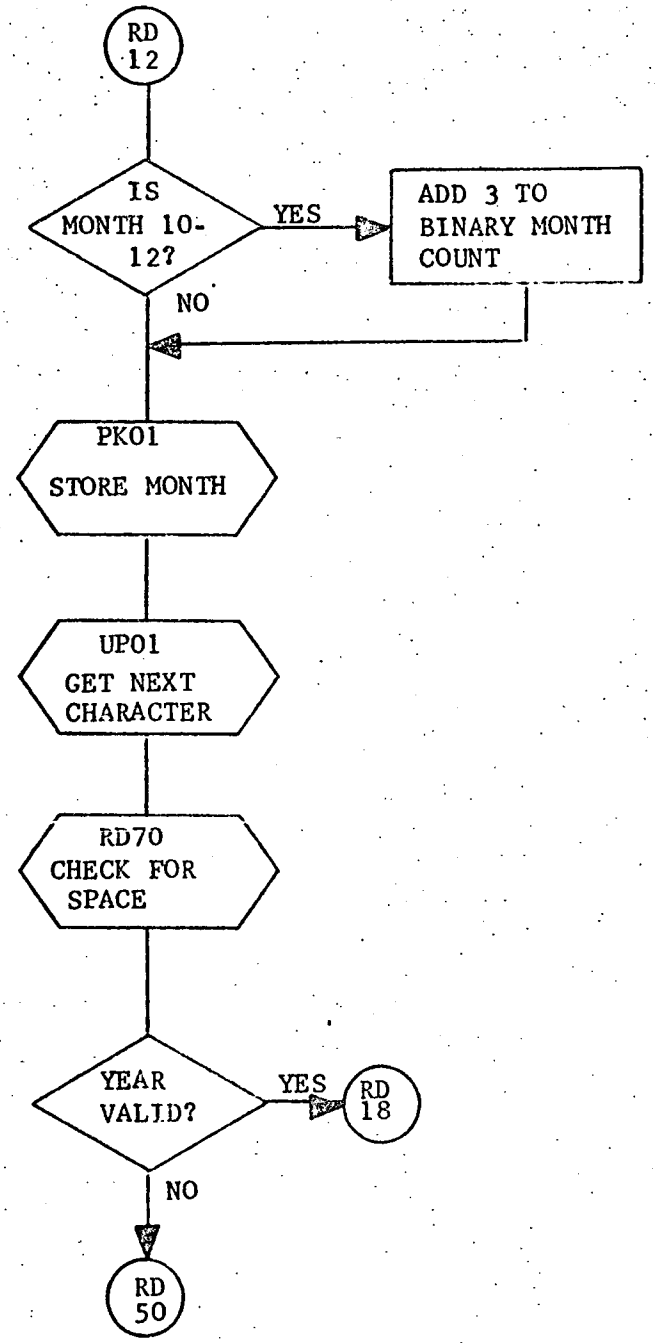
UP00 - unpack character routine

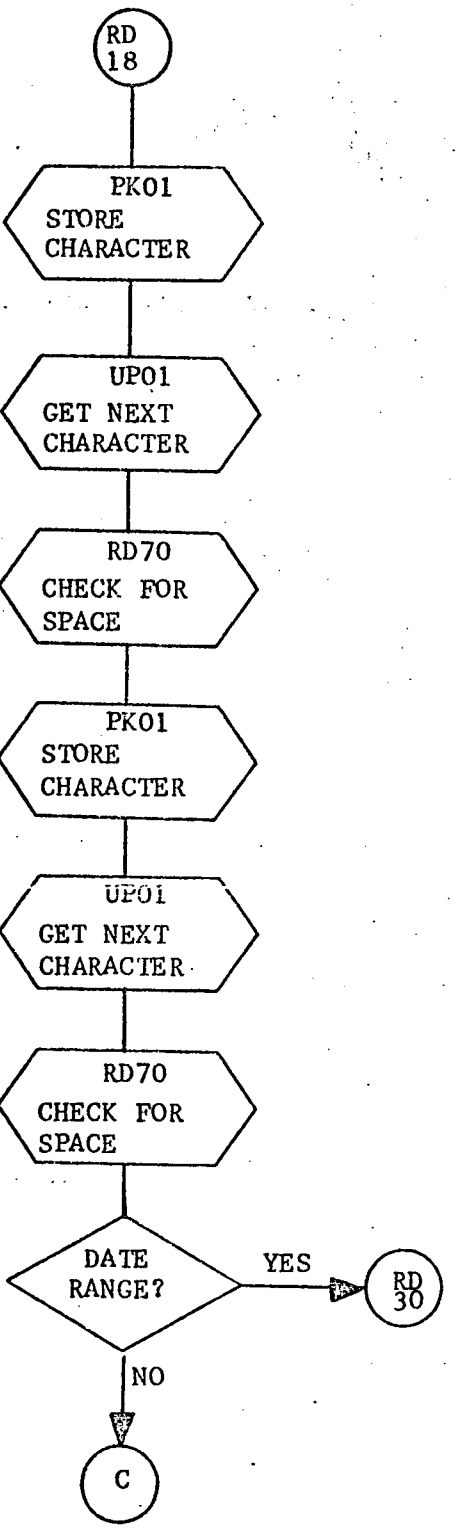
3.3.32.4 Detailed Flow Chart

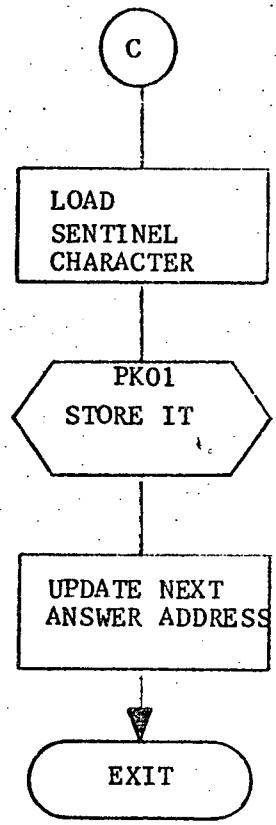


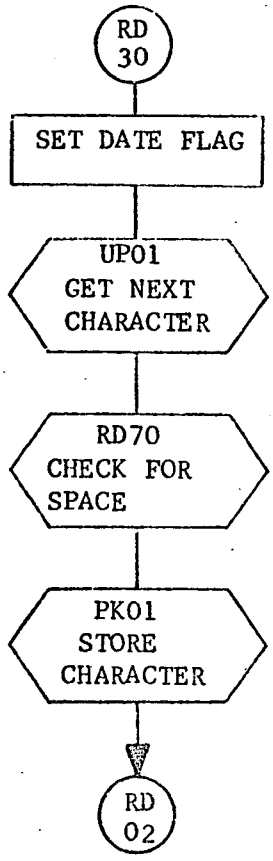

A
IS DAY < 1?
YES
NO
IS DAY > 31?
YES
RD 50
NO
PK01 STORE CHARACTER
UP01 GET NEXT CHARACTER
RD70 CHECK FOR SPACE
UP01 GET NEXT CHARACTER
RD70 CHECK FOR SPACE
PK01 STORE ZERO
B

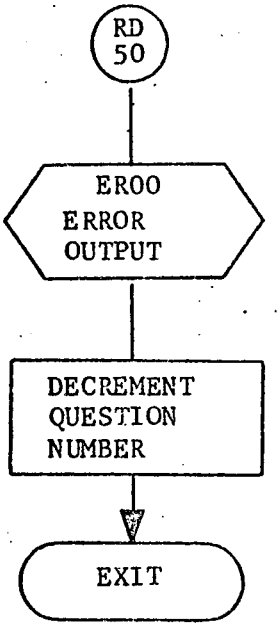

B
UP01
GET NEXT
CHARACTER
RD70
CHECK FOR
SPACE
RD
10
MONTH
VALID?
YES
RD
12
NO
END
OF MONTH
TABLE
YES
RD
50
NO
INCREMENT
TABLE INDEX
RD
10

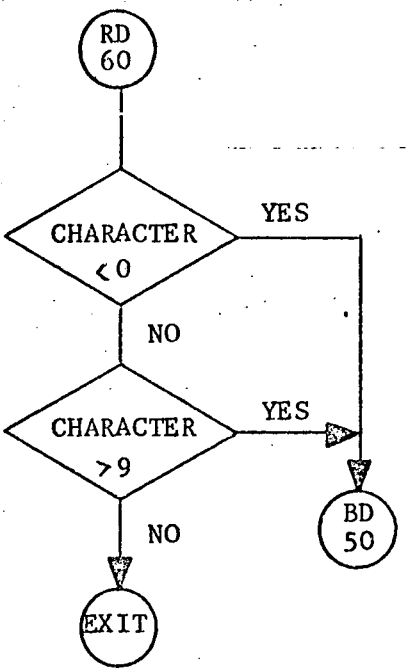

RD
12
IS
MONTH 10-
12?
YES
ADD 3 TO
BINARY MONTH
COUNT
NO
PK01
STORE MONTH
UP01
GET NEXT
CHARACTER
RD70
CHECK FOR
SPACE
YEAR
VALID?
YES
RD
18
NO
RD
50

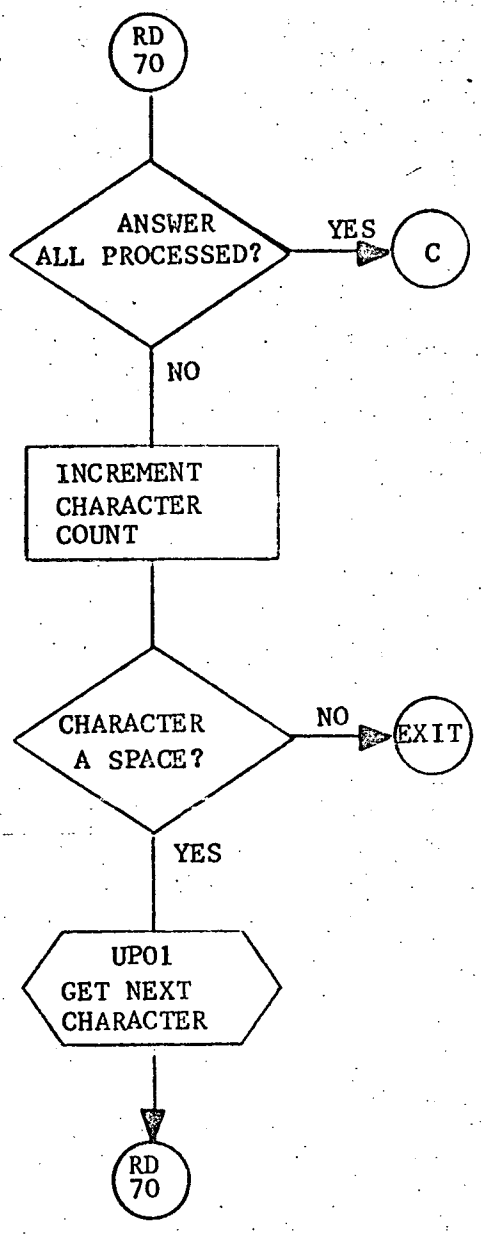

RD
18
PK01
STORE
CHARACTER
UP01
GET NEXT
CHARACTER
RD70
CHECK FOR
SPACE
PK01
STORE
CHARACTER
UP01
GET NEXT
CHARACTER
RD70
CHECK FOR
SPACE
DATE
RANGE?
YES
RD
30
NO
C


C
LOAD SENTINEL CHARACTER
PK01 STORE IT
UPDATE NEXT ANSWER ADDRESS
EXIT


RD 30
SET DATE FLAG
UP01 GET NEXT CHARACTER
RD70 CHECK FOR SPACE
PK01 STORE CHARACTER
RD 02


RD
50
EROO
ERROR
OUTPUT
DECREMENT
QUESTION
NUMBER
EXIT


RD
60
CHARACTER
< 0
YES
NO
CHARACTER
> 9
YES
NO
BD
50
EXIT


RD
70
ANSWER
ALL PROCESSED?
YES
C
NO
INCREMENT
CHARACTER
COUNT
CHARACTER
A SPACE?
NO
EXIT
YES
UP01
GET NEXT
CHARACTER
RD
70

3.3.33 RM00 - Record Match

3.3.33.1 Purpose

RM00 is a subroutine whose purpose is to determine if the current master record matches the user selection criteria of the retrieval request.

3.3.33.2 Technical Description

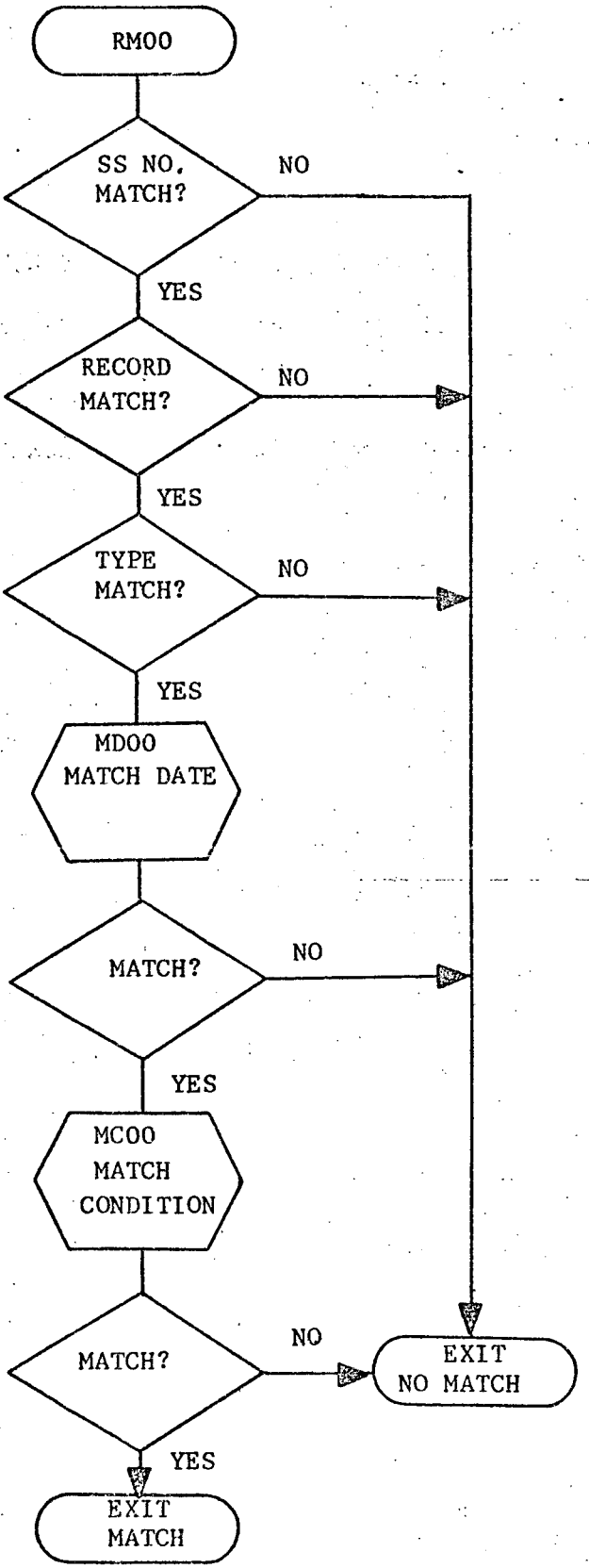
Each response in the selection criteria of the retrieval request must be matched before a record is accepted for further processing by other modules of the system. If a match does not occur on any one of the responses, the tape record is rejected. If, however, a match is found for all five responses, the record is accepted and control is transferred to the Control Program (CP00). RM00 performs the match test in the following order: SS NO, RECORD, TYPE, DATE, CONDITION. The results of the match are passed to the Control Program via the X-register. If a match is found, a one is returned in the X-register; if the ID portion of the request (SS NO, RECORD, TYPE, DATE) is less than the corresponding entry in the current master record, a two is returned; otherwise, a zero is returned.

3.3.33.2.1 Calling Sequence

```
CALL     RM00
```

REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	Saved upon entry	Restored upon exit
B	Saved upon entry	Restored upon exit
X	N/A	Status of the compare
Overflow	N/A	N/A

3.3.18.2.2 General Flow Chart



3.3.33.3 Label Description

3.3.33.3.1 Local

RMBF - a 13 word buffer used for temporary storage for each request parameter as it is being processed.

RMCT - storage location used to save the starting address of each request parameter as it is being processed.

RMFG - flag that is set if request data has been found.

RMKA - temporary starting location for the contents of the A-register.

RMKX - temporary starting location for the contents of the X-register.

RMPT - counter which signifies how many characters have been processed for this request parameter.

RMSA - temporary starting location for the contents of the B-register.

RMSB - temporary starting location for the contents of the B-register.

3.3.33.3.2 Global

N/A

3.3.33.3.3 Entry Point

RM00 - primary entry point

3.3.33.3.4 External References

3.3.33.3.4.1 External Labels

CPRB - beginning address of the Request Buffer

CPRT - storage location which contains the first word of the request SS NO

CPTB - beginning address of the Tape Input Buffer

3.3.33.3.4.2 External Subroutines

CMOO - Compare two values

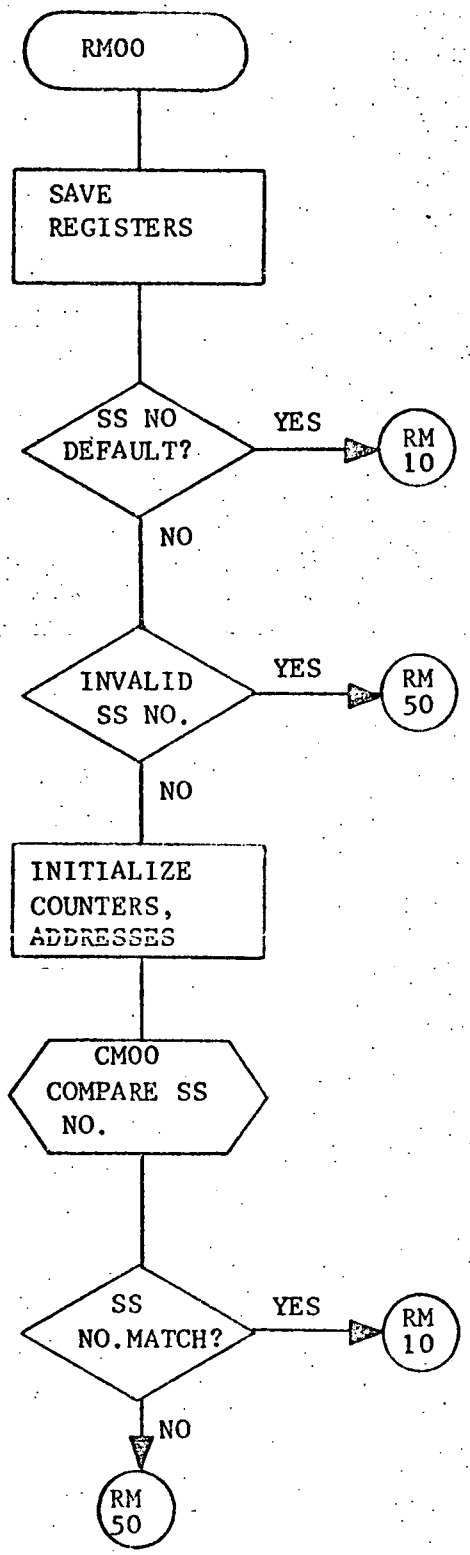
MCOO - Match condition

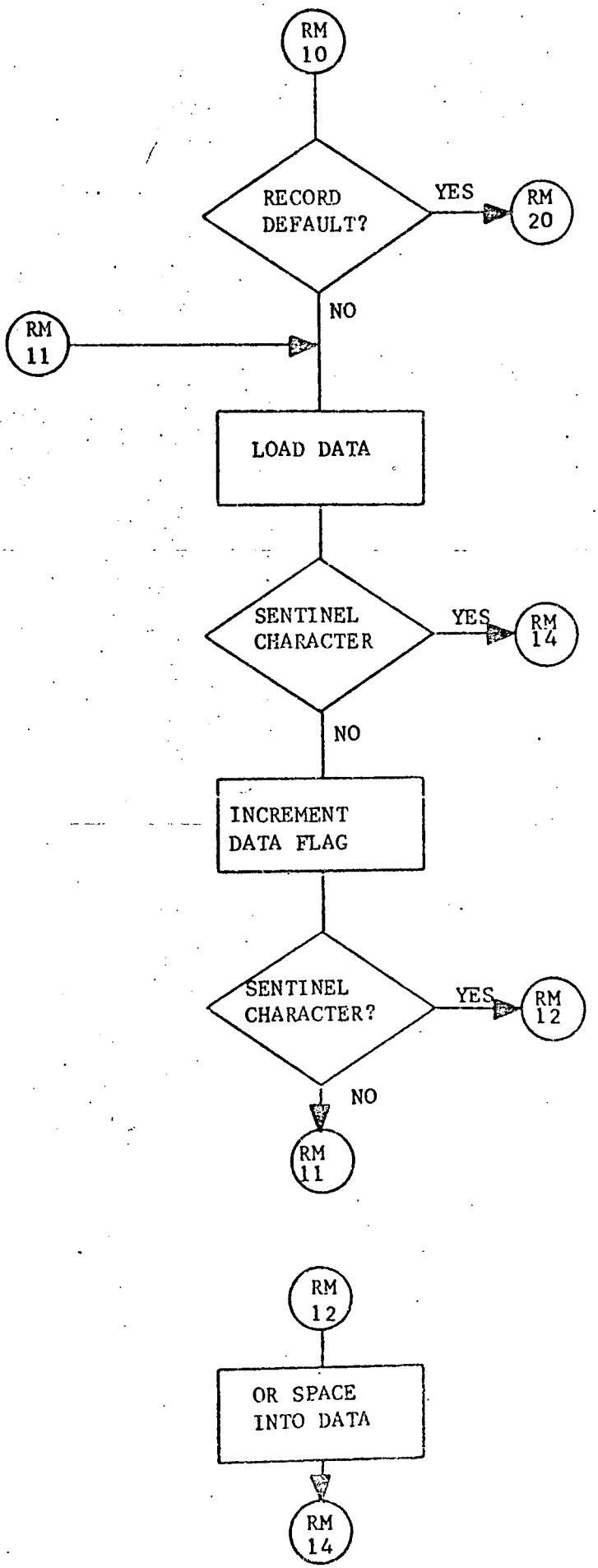
MDOO - Match date

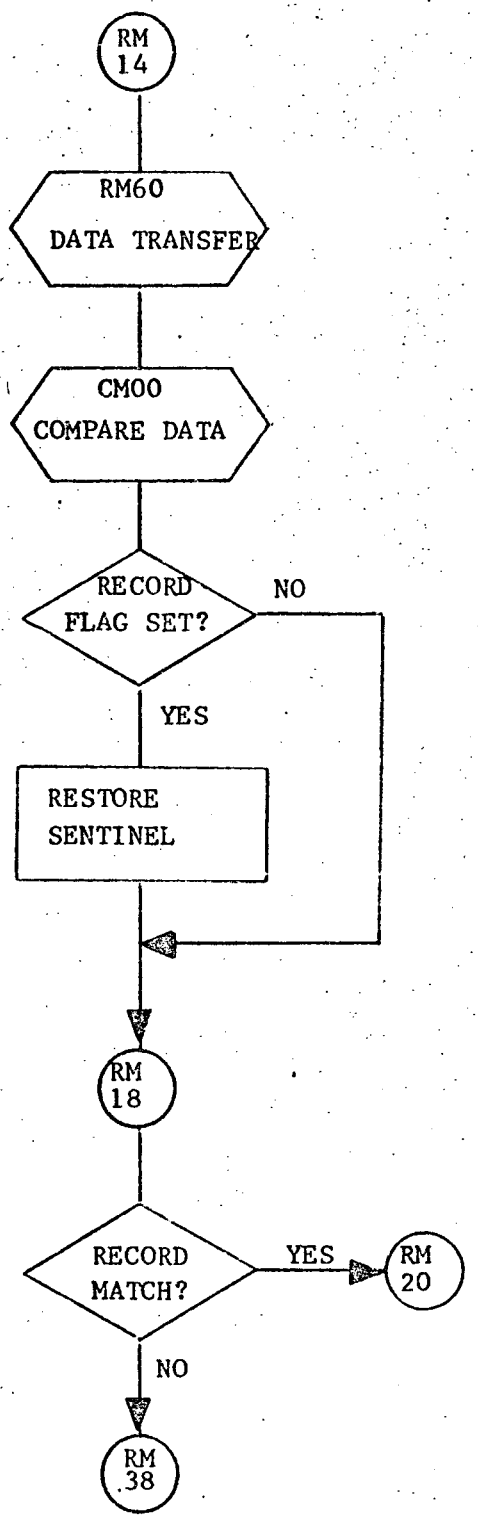
PKOO - Pack character

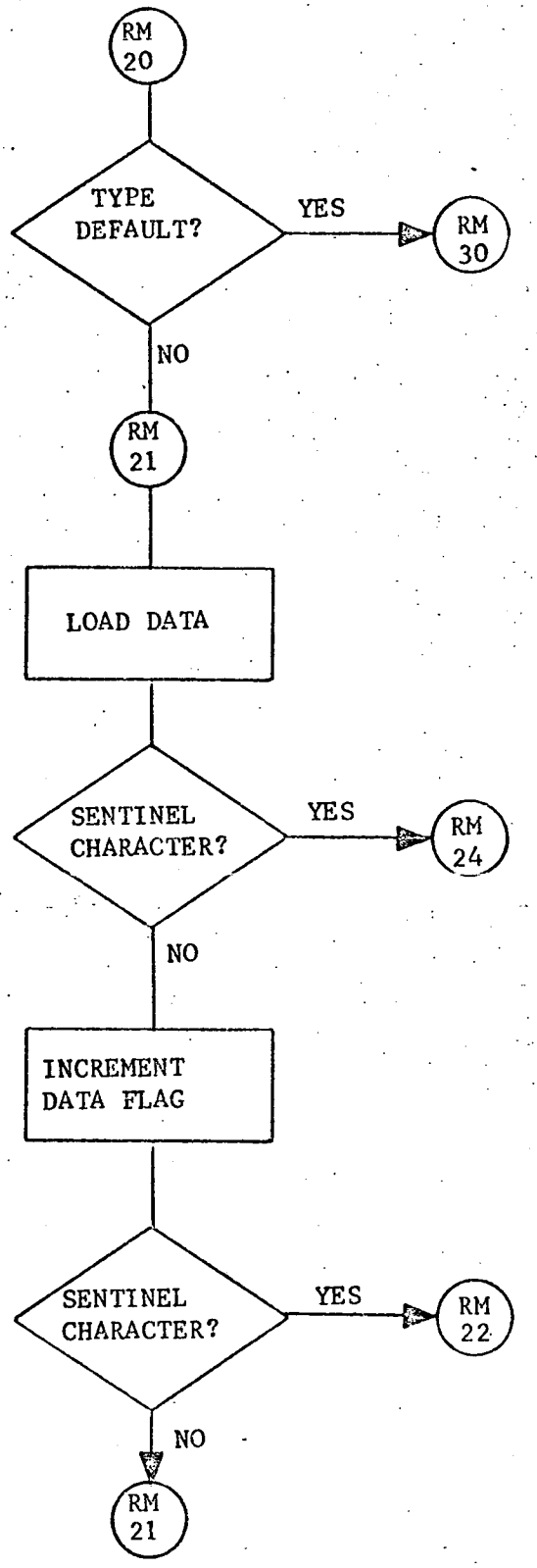
UPOO - Unpack character

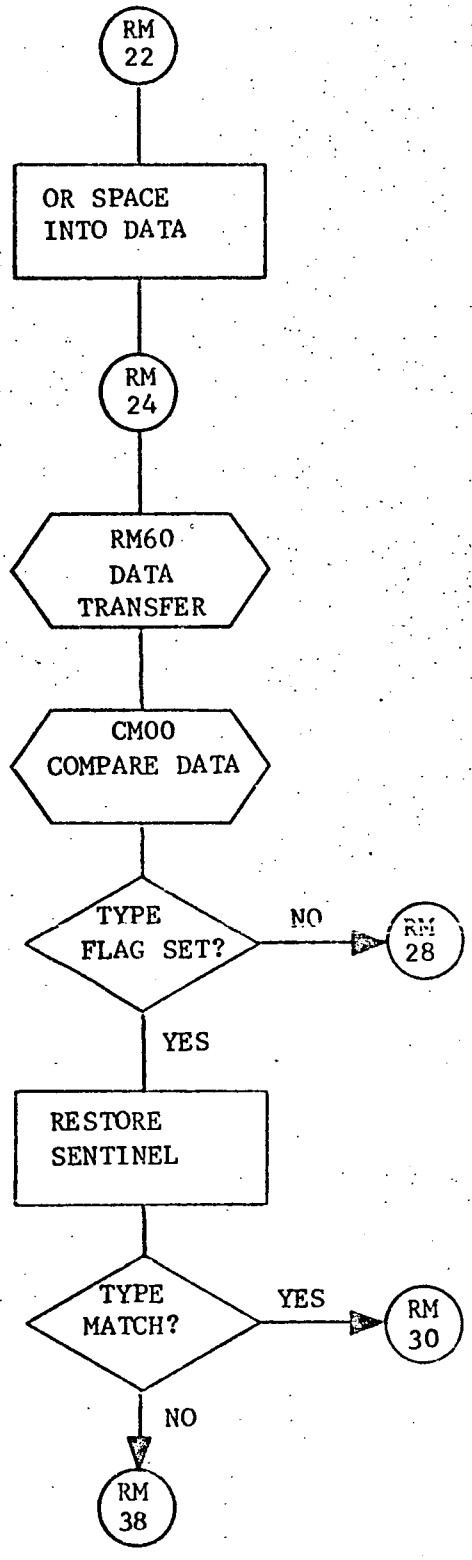
3.3.33.4 Detailed Flow Chart

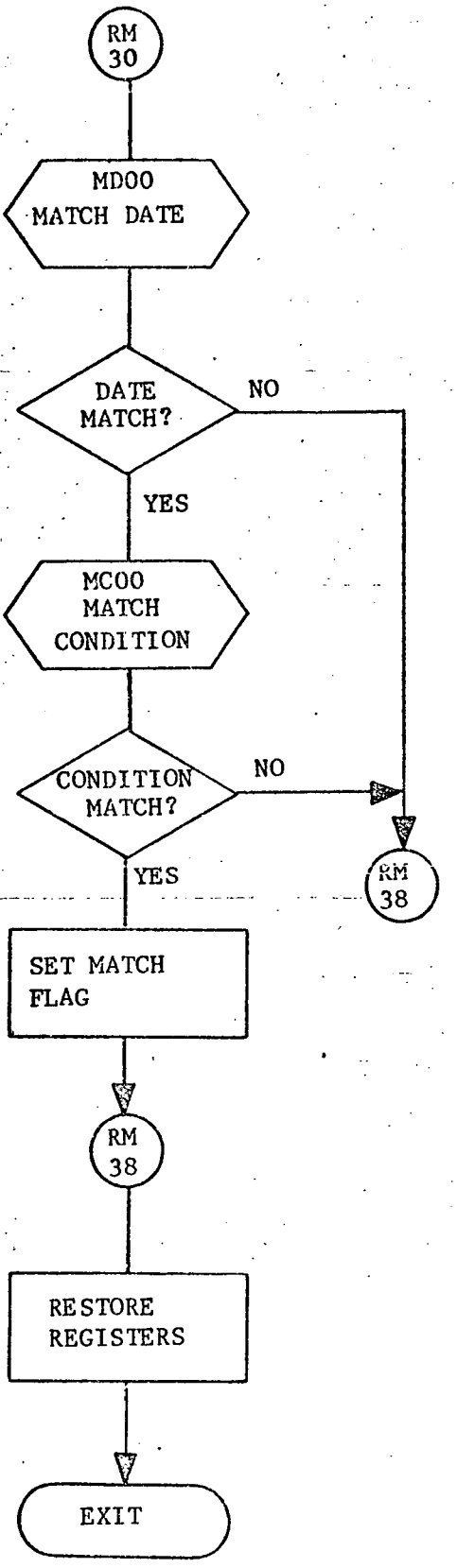


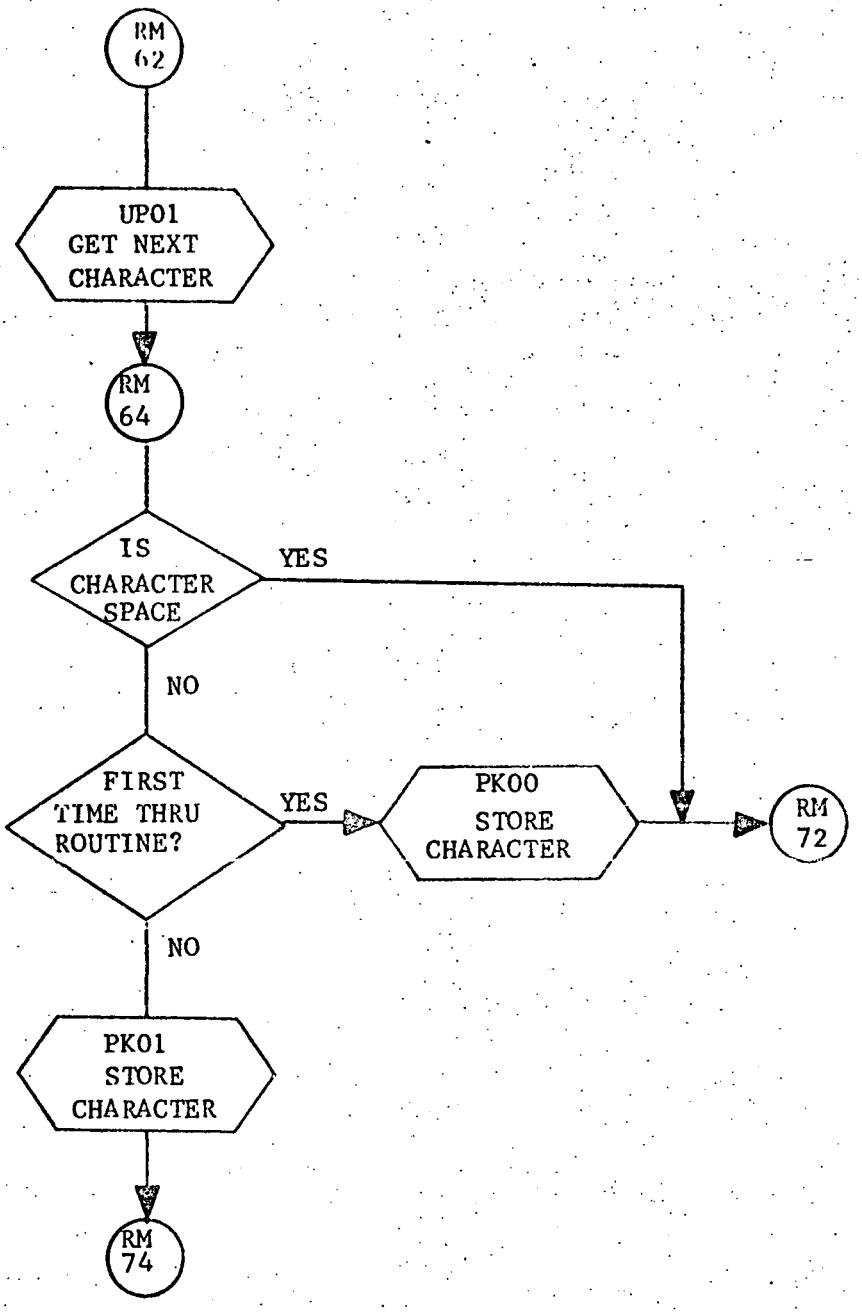

RM 10
RECORD DEFAULT?
YES
RM 20
NO
RM 11
LOAD DATA
SENTINEL CHARACTER
YES
RM 14
NO
INCREMENT DATA FLAG
SENTINEL CHARACTER?
YES
RM 12
NO
RM 11
RM 12
OR SPACE INTO DATA
RM 14

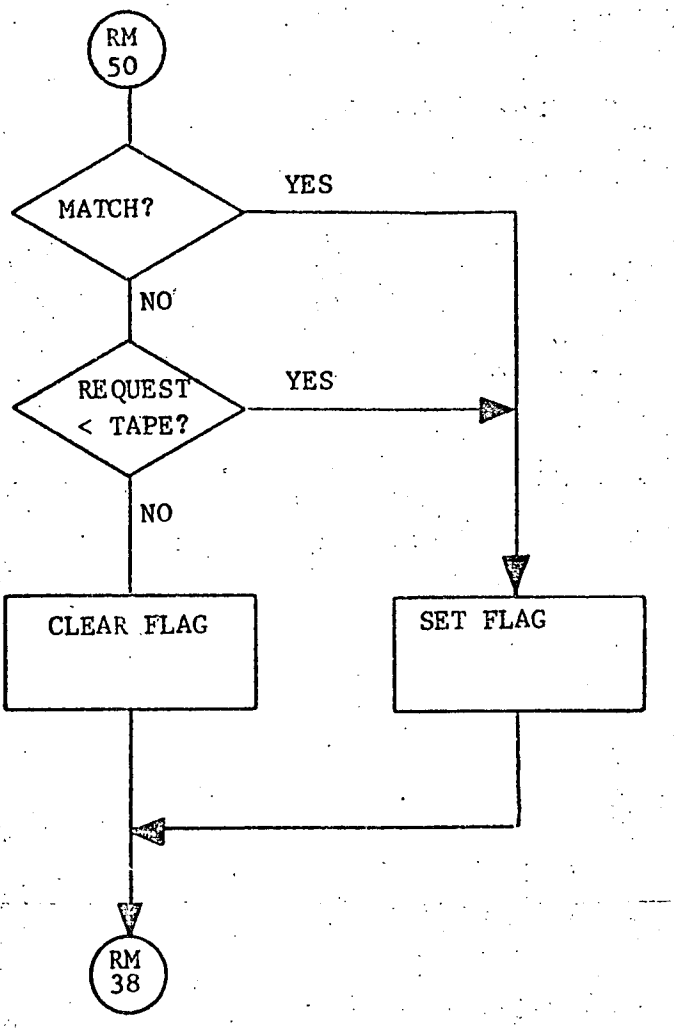

RM
14
RM60
DATA TRANSFER
CM00
COMPARE DATA
RECORD
FLAG SET?
NO
YES
RESTORE
SENTINEL
RM
18
RECORD
MATCH?
YES
RM
20
NO
RM
38

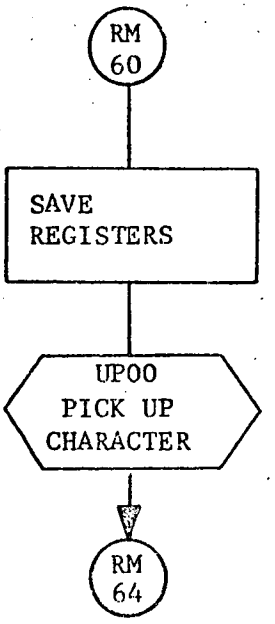

RM
20
TYPE
DEFAULT?
YES
RM
30
NO
RM
21
LOAD DATA
SENTINEL
CHARACTER?
YES
RM
24
NO
INCREMENT
DATA FLAG
SENTINEL
CHARACTER?
YES
RM
22
NO
RM
21

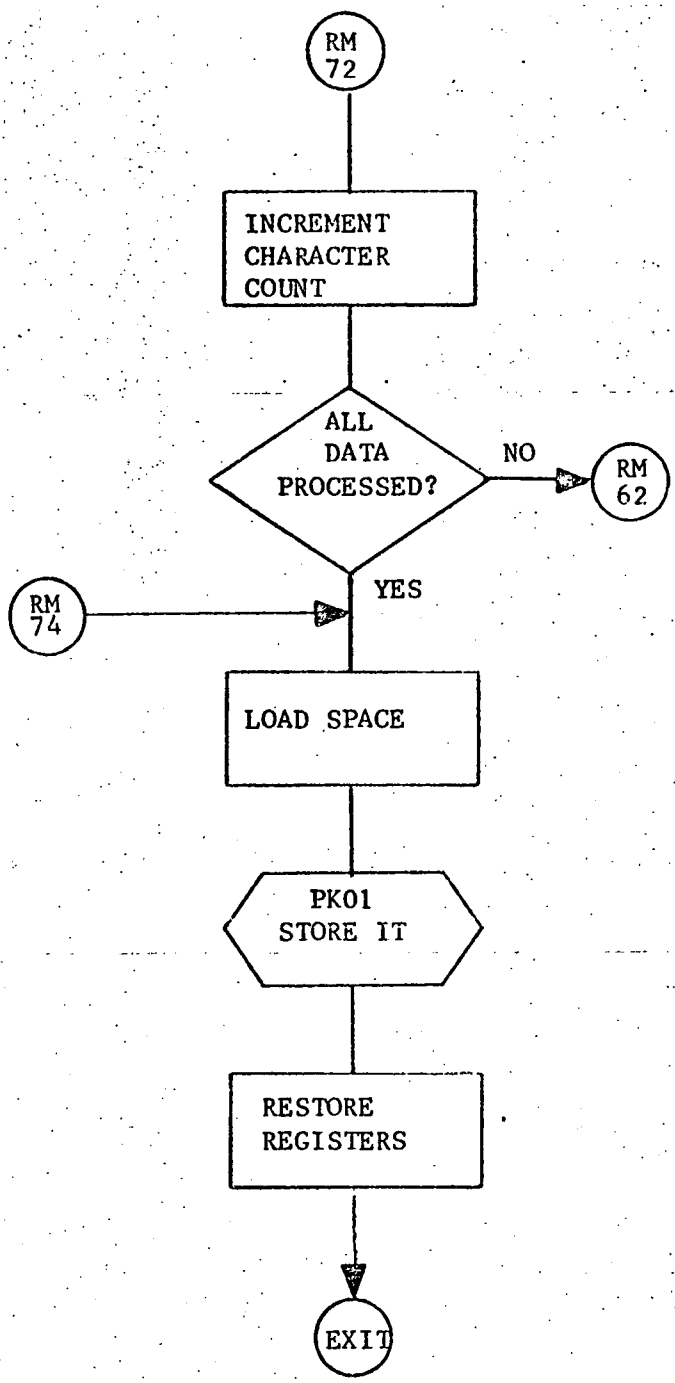

RM
22
OR SPACE
INTO DATA
RM
24
RM60
DATA
TRANSFER
CM00
COMPARE DATA
TYPE
FLAG SET?
NO
RM
28
YES
RESTORE
SENTINEL
TYPE
MATCH?
YES
RM
30
NO
RM
38


RM
30
MD00
MATCH DATE
DATE
MATCH?
NO
YES
MC00
MATCH
CONDITION
CONDITION
MATCH?
NO
YES
RM
38
SET MATCH
FLAG
RM
38
RESTORE
REGISTERS
EXIT


RM
62
UP01
GET NEXT
CHARACTER
RM
64
IS
CHARACTER
SPACE
YES
NO
FIRST
TIME THRU
ROUTINE?
YES
PK00
STORE
CHARACTER
RM
72
NO
PK01
STORE
CHARACTER
RM
74


RM
50
MATCH?
YES
NO
REQUEST
< TAPE?
YES
NO
CLEAR FLAG
SET FLAG
RM
38


RM
60
SAVE
REGISTERS
UP00
PICK UP
CHARACTER
RM
64


RM
72
INCREMENT
CHARACTER
COUNT
ALL
DATA
PROCESSED?
NO
RM
62
YES
RM
74
LOAD SPACE
PK01
STORE IT
RESTORE
REGISTERS
EXIT

3.3.34 RQ00 Request

3.3.34.1 Purpose

RQ00, the Request Subroutine, outputs all the questions to be answered and accepts the answer from the user. Each response is edited for line error, abort, and input complete codes. If the default parameter has been entered, the subroutine sets the default flag and proceeds to the next question. If the default parameter is not the response, the subroutine sends control to the subroutine corresponding to question number to edit the answer. When all questions have been answered, the subroutine returns control to RP00, the Control Program.

3.3.34.2 Technical Description

The subroutine saves the A, B and X-registers, and the question number pointer is initialized to zero. The following pointers are initialized as follows:

POINTER	INITIALIZED TO
CPXB Bool	CPBB, address of first word of BOOL Buffer
CPXO Operand	CPOB, address of first word of Operand Buffer
CPXR Request	CPRB, address of first word of Request Buffer
CPXC Condition	CPCT, address of first word of Condition Table
CPXW What	CPWT, address of first word of What Table

3.3.34.2 Technical Description (Continued)

The subroutine displays the question based on question number by accessing the address of the appropriate message from RQAM. The messages are listed below:

QUESTION NUMBER	MESSAGE
0	'SS-NO'
1	'RECORD'
2	'TYPE'
3	'CONDITION'
4	'DATE'
5	'ACTION'
6	'WHAT'

The Input Message Routine (IM00) is called to accept the response from the user. The status word set by IM00 is checked to determine the action to be taken.

STATUS WORD	ACTION TO BE TAKEN
> 0	Input complete - process data
-1	Input busy - wait for completion
-2	Line Error - repeat question
-3	Abort - Repeat SS-NO.
0	Default value - set Request Table entry to zero

3.3.34.2 Technical Description (Continued)

When the status word is greater than zero, the response is compared against the corresponding entry in the default table (RQDT). See Table 1. If the default condition is true, zero is set in the word of the Request Table corresponding to question number, and the next question is processed.

RQDT TABLE

QUESTION	DEFAULT CONDITION
0	'ALL'
1	'ALL'
2	'ALL'
3	'ALL'
4	'NONE'
5	'LIST'
6	'ALL'

Table 1

If the response is not the default condition, the address of appropriate subroutine needed to process the answer is retrieved from end-action table (RQET) and the subroutine called. See Table 2. On return RQ00 determines if all questions have been answered. If they have, the registers are restored and control is returned to CP00. If they have not, the next question is displayed.

END ACTION TABLE (RQET)

QUESTION NUMBER	SUBROUTINE
0	RS00
1	RR00
2	RR00
3	RD00
4	RC00
5	RA00
6	RC00

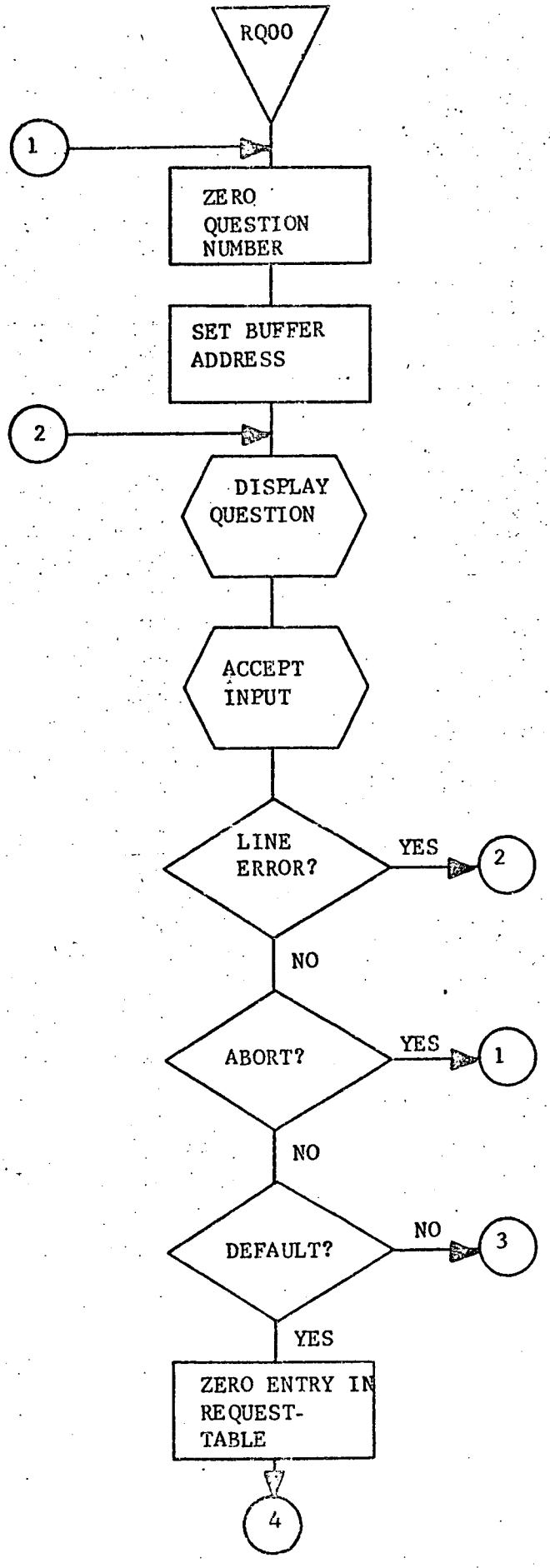
Table 2

3.3.34.2.1 Calling Sequence

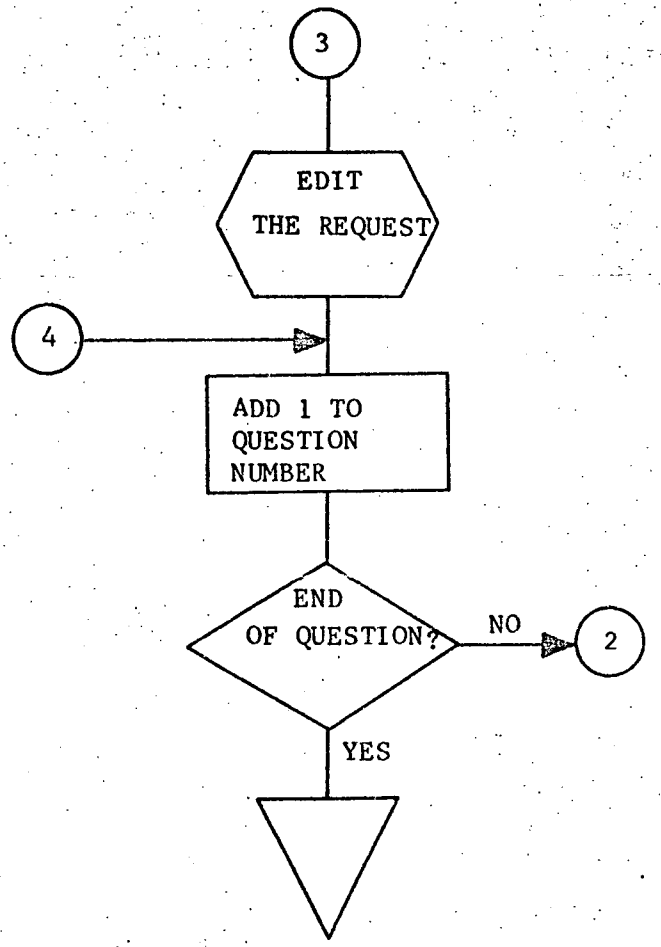
CALL RQ00

REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	N/A	Same
B	N/A	Same
X	N/A	Same
Overflow	N/A	Modified

3.3.34.2.2 General Flow Chart



RQ00


3
EDIT
THE REQUEST
4
ADD 1 TO
QUESTION
NUMBER
END
OF QUESTION?
NO
2
YES

3.3.34.3 Label Description

3.3.34.3.1 Local

RQAC 'ACTION' Message

RQAM 7 word Table of Address of Message (See Section 3.3.34.2)

RQCN 7 word Table containing Length of Messages

Entry as follows:

8	SS-NO
10	RECORD
8	TYPE
8	DATE
13	CONDITION
10	ACTION
8	WHAT

RQCO 'CONDITION' Message

RQCU Max. number of 240, the max input character

RQDA 'DATE' Message

RQDT 7 word table of address of default test. See Table 1.

RQD5 'SS NO' Message

RQET 7 word Table of Address of end action. See Table 2.

RQRE 'RECORD' Message

3.3.34.3.1 Local (Continued)

RQSA Temporary location to save register A on entry.

RQSB Temporary location to save register B on entry.

RQSX Temporary location to save Register X on entry.

RQTP 'TYPE' Message

RQWH 'WHAT' Message

RQXT Temporary Index

RQ37 Mask to mask out two characters - 7 bits.

3.3.34.3.2 Global

RQQN Question number, referenced by RS00, RR00, RD00, RC00, and RA00.

RQTB Temporary input buffer; referenced by following subroutines: RS00, RR00, RD00, RC00, and RA00.

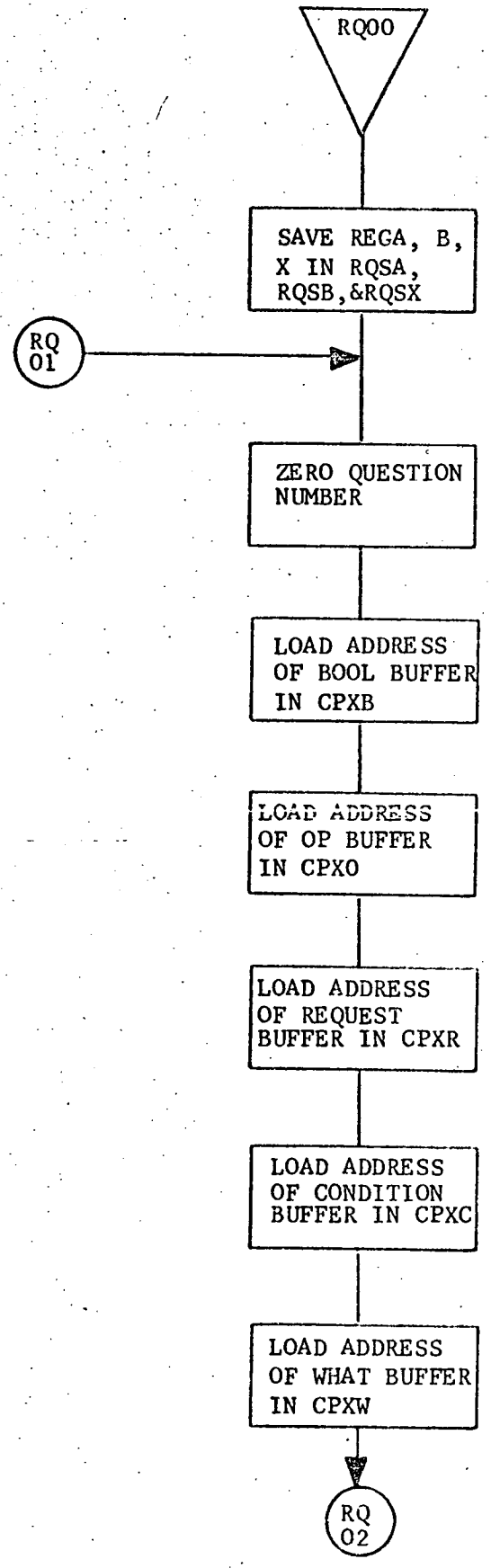
3.3.34.3.3 Entry Point

RQ00

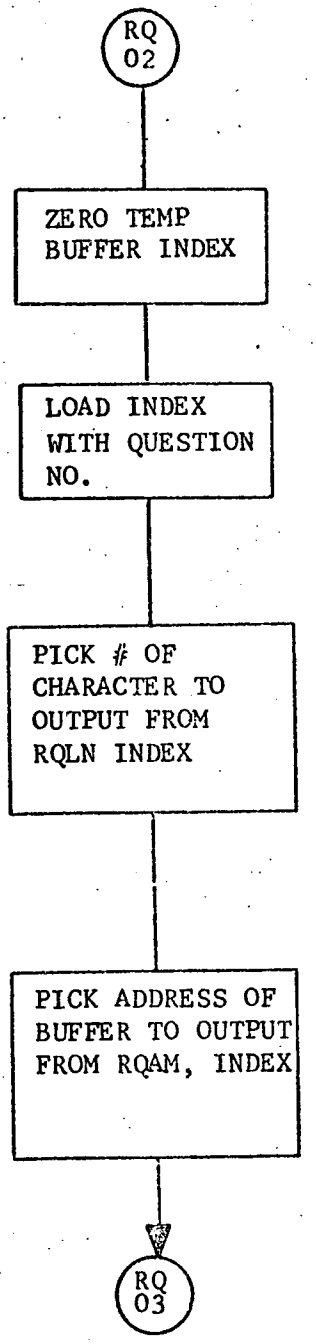
3.3.34.3.4 External References

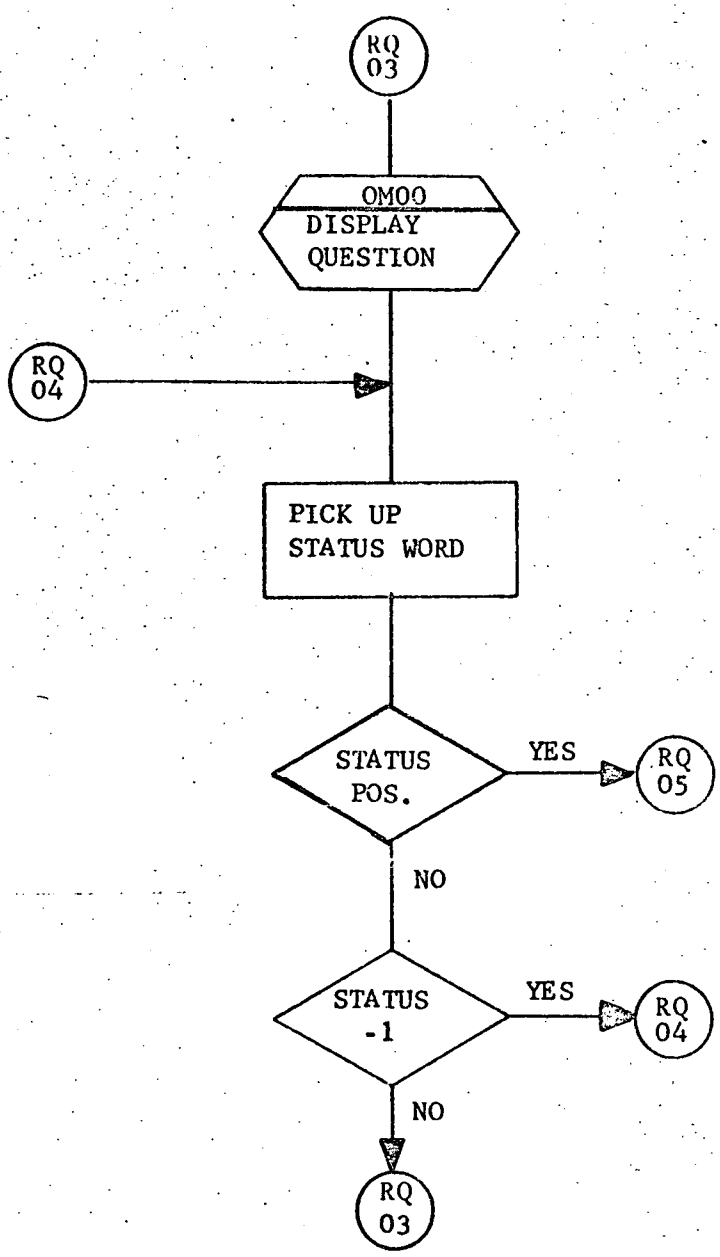
CPBB	Defined in Appendix C, Bool Buffer
CPCT	Defined in Appendix F, Condition Table
CPNC	Defined in CP00, the number of characters input through IM00
CPOB	Defined in Appendix D, Operand Buffer
CPRB	Defined in Appendix E, Request Buffer
CPSW	Defined in CP00, Status Word for Input and Output Routine
CPWT	Defined in Appendix G, What Table
CPXB	Defined in CP00, Pointer into Bool Buffer
CPXC	Defined in CP00, Pointer into Condition Table
CPXO	Defined in CP00, Pointer into Operand Buffer
CPXR	Defined in CP00, Pointer into Request Buffer
CPXW	Defined in CP00, Pointer into What Table
ER00	Subroutine to Output Error Message
IM00	Subroutine to accept input for User
OM00	Subroutine to Output Question
RA00	Subroutine to process 'ACTION' Response
RC00	Subroutine to process 'CONDITION' and 'WHAT' Response
RD00	Subroutine to process 'DATE' Response
RR00	Subroutine to process 'RECORD and 'TYPE' Response
RS00	Subroutine to process 'SS-NO' Response

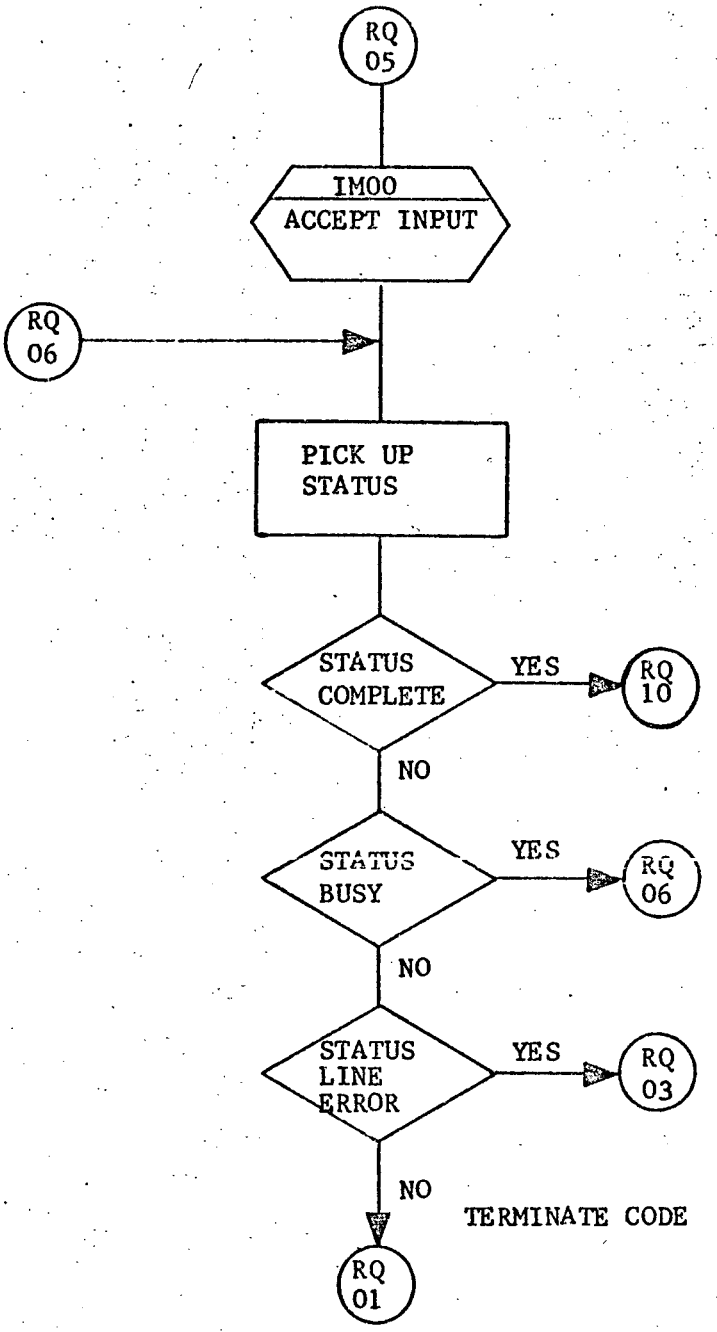
3.3.34.4 Detailed Flow Chart



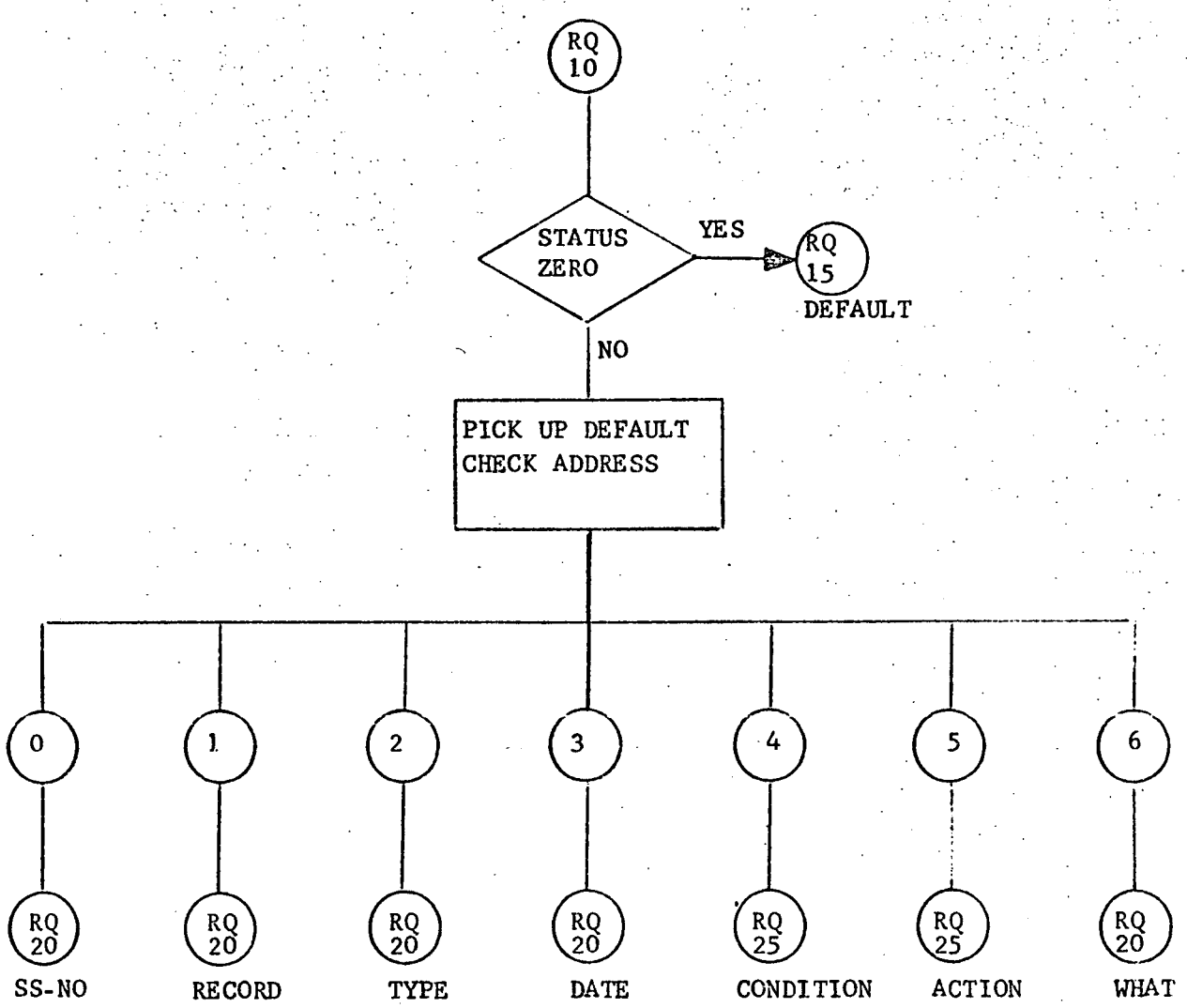
RQ00
1 OF 8


RQ
02
ZERO TEMP
BUFFER INDEX
LOAD INDEX
WITH QUESTION
NO.
PICK # OF
CHARACTER TO
OUTPUT FROM
RQLN INDEX
PICK ADDRESS OF
BUFFER TO OUTPUT
FROM RQAM, INDEX
RQ
03

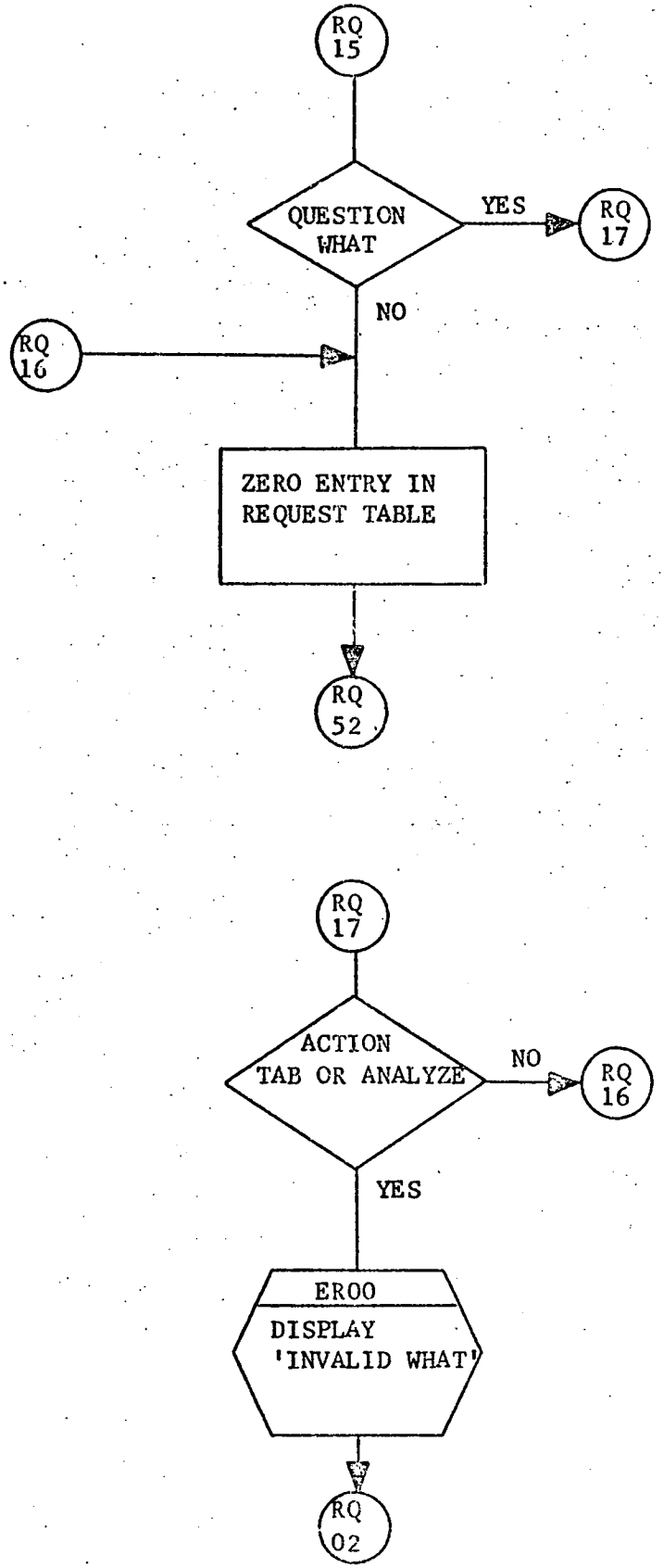

RQ 03
OM00
DISPLAY QUESTION
RQ 04
PICK UP STATUS WORD
STATUS POS.
YES
RQ 05
NO
STATUS -1
YES
RQ 04
NO
RQ 03


RQ
05
IM00
ACCEPT INPUT
RQ
06
PICK UP
STATUS
STATUS
COMPLETE
YES
RQ
10
NO
STATUS
BUSY
YES
RQ
06
NO
STATUS
LINE
ERROR
YES
RQ
03
NO
TERMINATE CODE
RQ
01

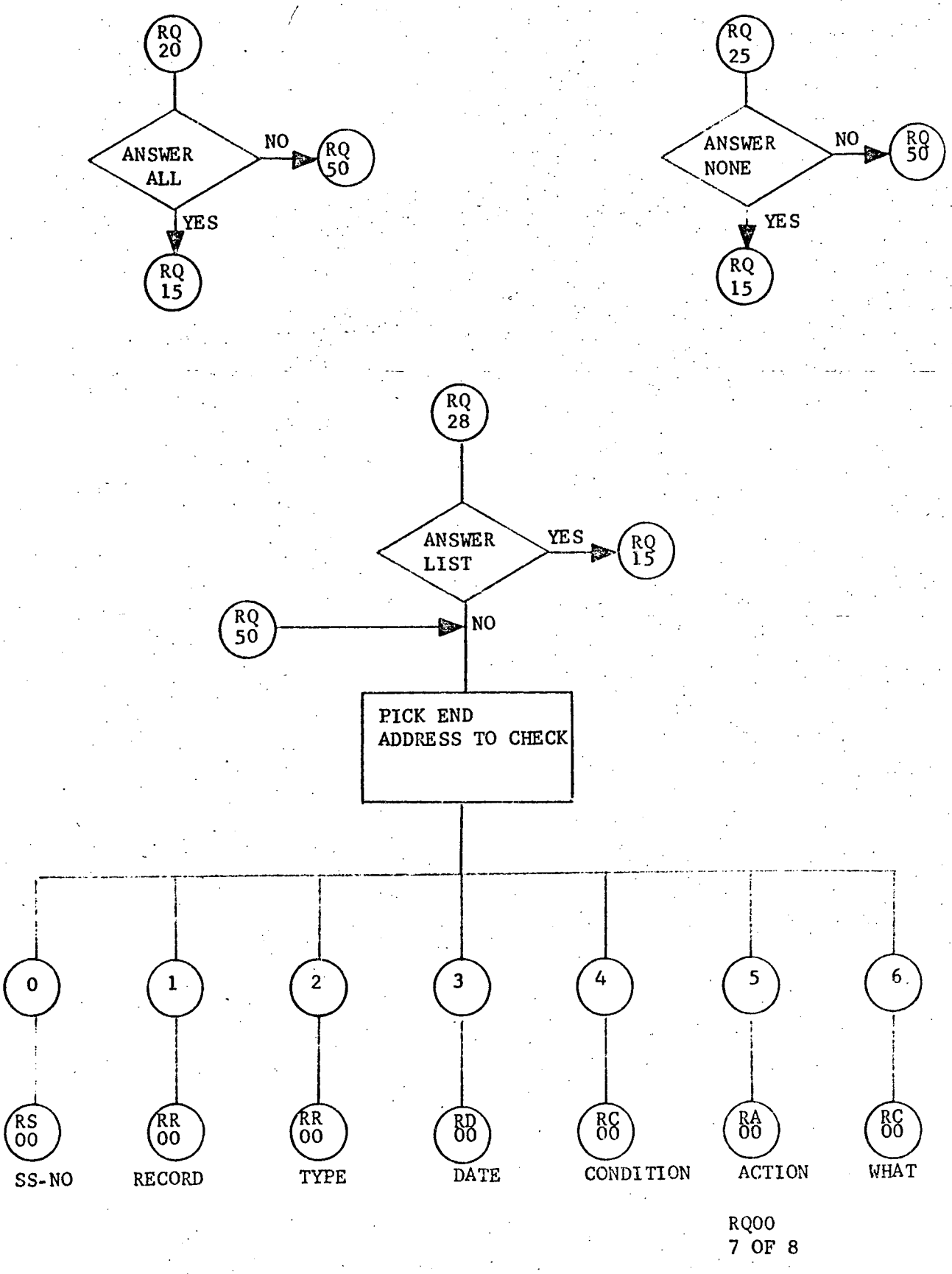
RQ00
4 OF 8


RQ 10
STATUS ZERO
YES
RQ 15
DEFAULT
NO
PICK UP DEFAULT
CHECK ADDRESS
0
1
2
3
4
5
6
RQ 20
RQ 20
RQ 20
RQ 20
RQ 25
RQ 25
RQ 20
SS-NO
RECORD
TYPE
DATE
CONDITION
ACTION
WHAT

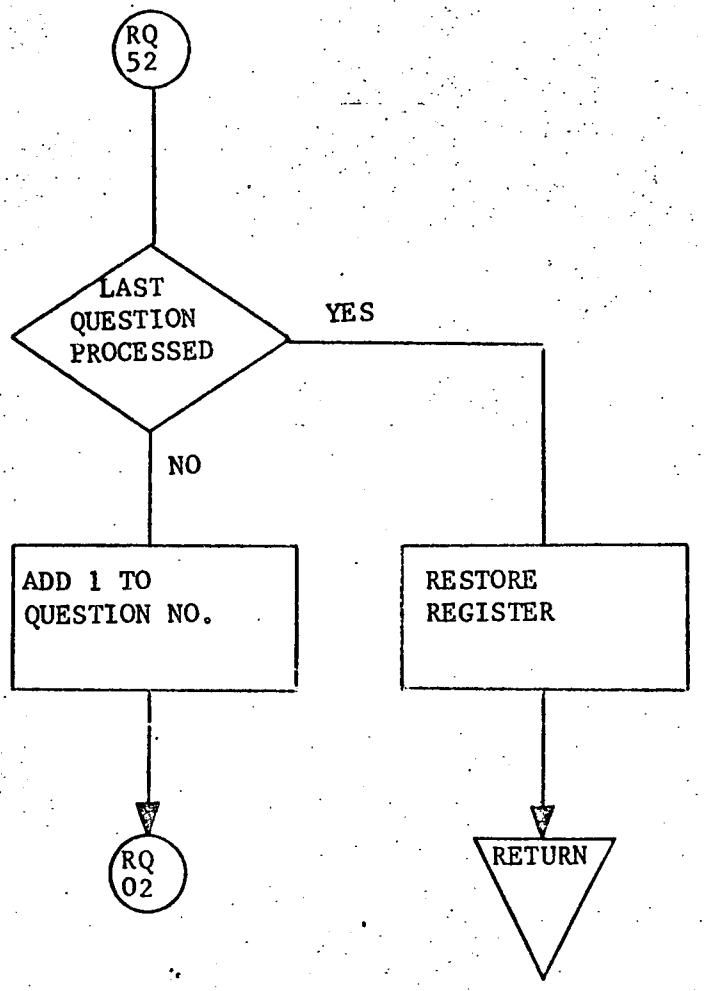
RQ00
5 OF 8


RQ 15
QUESTION WHAT
YES
RQ 17
NO
RQ 16
ZERO ENTRY IN REQUEST TABLE
RQ 52
RQ 17
ACTION TAB OR ANALYZE
NO
RQ 16
YES
ER00
DISPLAY 'INVALID WHAT'
RQ 02

RQ00
6 OF 8


RQ 20
ANSWER ALL
NO
RQ 50
YES
RQ 15
RQ 25
ANSWER NONE
NO
RQ 50
YES
RQ 15
RQ 28
ANSWER LIST
YES
RQ 15
RQ 50
NO
PICK END ADDRESS TO CHECK
0
1
2
3
4
5
6
RS 00
RR 00
RR 00
RD 00
RC 00
RA 00
RC 00
SS-NO
RECORD
TYPE
DATE
CONDITION
ACTION
WHAT

RQ00
7 OF 8


RQ
52
LAST
QUESTION
PROCESSED
YES
NO
ADD 1 TO
QUESTION NO.
RESTORE
REGISTER
RQ
02
RETURN

RQ00
8 OF 8

3.3.35 RR00 - Request Record and Type

3.3.35.1 Purpose

RR00 subroutine packs the user's response to the "RECORD" and "TYPE" queries into the request buffer.

3.3.35.2 Technical Description

The subroutine packs the response from "record" and "type" queries into the request buffer. If the number of characters is greater than twenty-four, an error message is output to the user, the question number is decremented by one, and control returned to RQ00.

If the number of characters is 24 or less, the next available address in the request buffer is picked up from CPXR to initialize the pack subroutine, PK00. Only non-space characters are packed into the request buffer. When the complete response has been packed in the request buffer, 177_8 is stored at the end of the buffer.

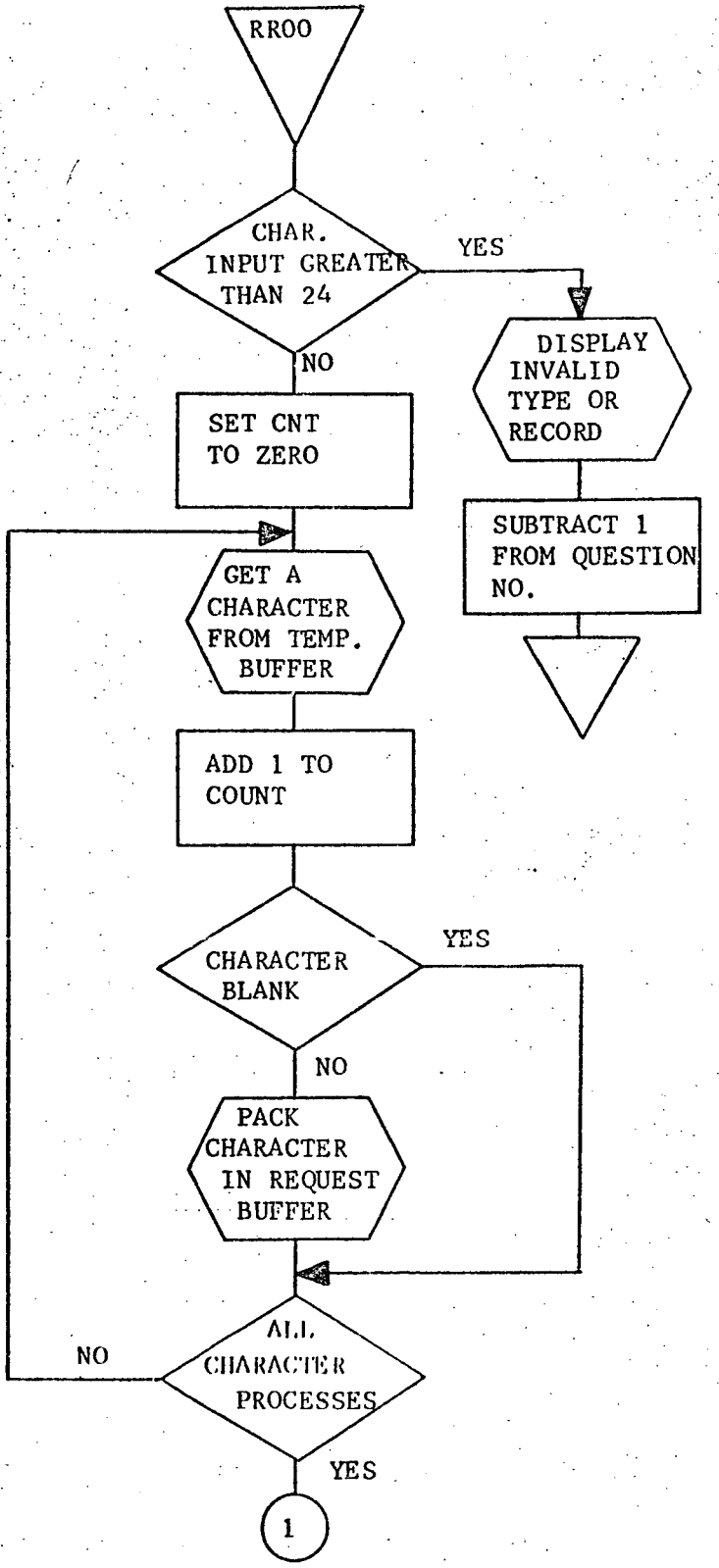
The address in CPXR is stored in the second word of Request-Table for record, or in the third word of the Request-Table for type. The next available address is computed by dividing (the number of character inputs +2) by 2 and storing it in CPXP. Control is then returned to RQ00.

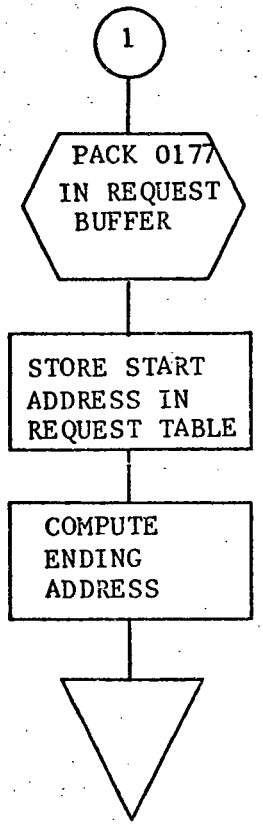
3.3.35.2.1 Calling Sequence

```
CALL      RR00
```

REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	N/A	Modified
B	N/A	Modified
X	N/A	Modified
Overflow	N/A	Modified

3.3.35.2.2 General Flow Chart




1
PACK 0177
IN REQUEST
BUFFER
STORE START
ADDRESS IN
REQUEST TABLE
COMPUTE
ENDING
ADDRESS

3.3.35.3 Label Description

3.3.35.3.1 Local

None

3.3.35.3.2 Global

None

3.3.35.3.3 Entry Point

RR00

3.3.35.3.4 External References

CPRT Defined in CP00, Request Table

CPSW Defined in CP00, contains number of character input

CPXR Defined in CP00, contains the next available location in the Request Buffer

ER00 Subroutine to output error message

PK00 Subroutine entry used to initialize the packing into the Request Buffer

PK01 Subroutine entry used to pack into the Request Buffer

RQQN Defined in EQ00, question number (i.e., 1 or Record, or 2 for Type.)

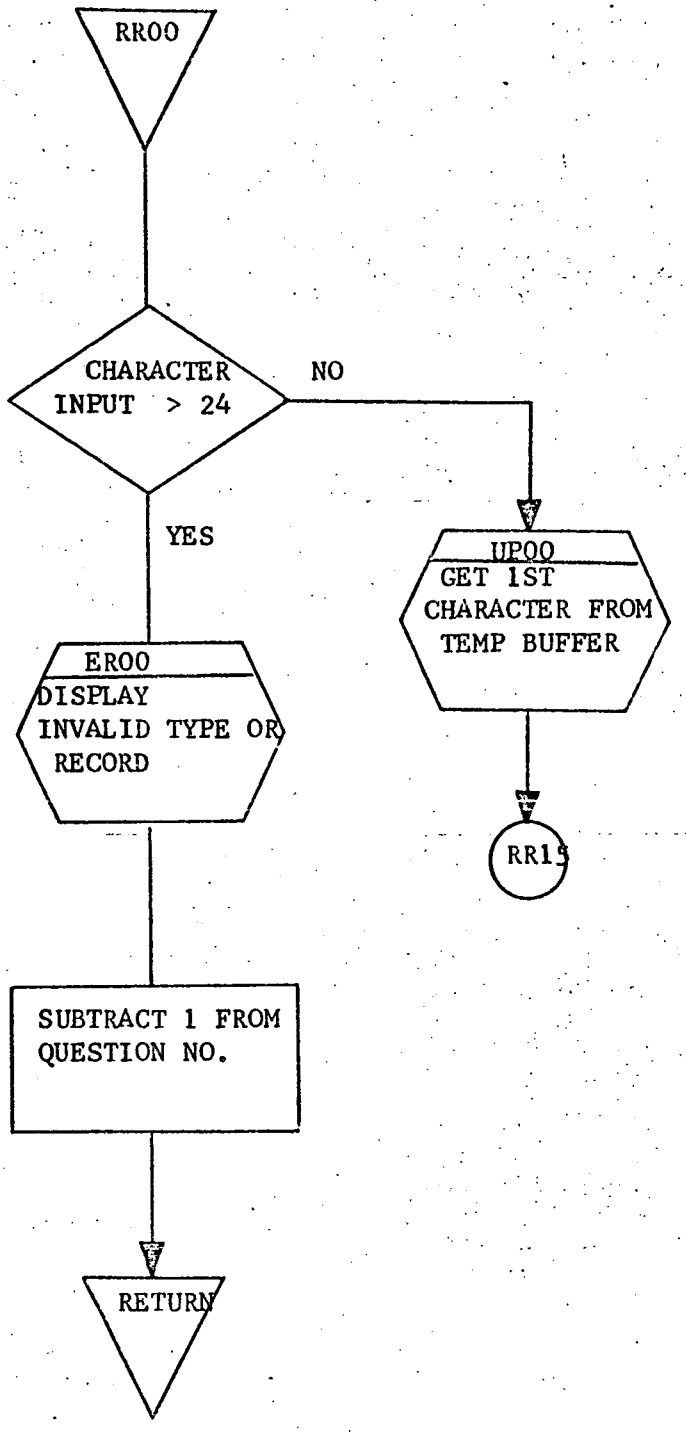
RQTB Defined in RQ00, temporary Input Buffer

RSMK Defined in RS00, 7 bit mask for ASCII code.

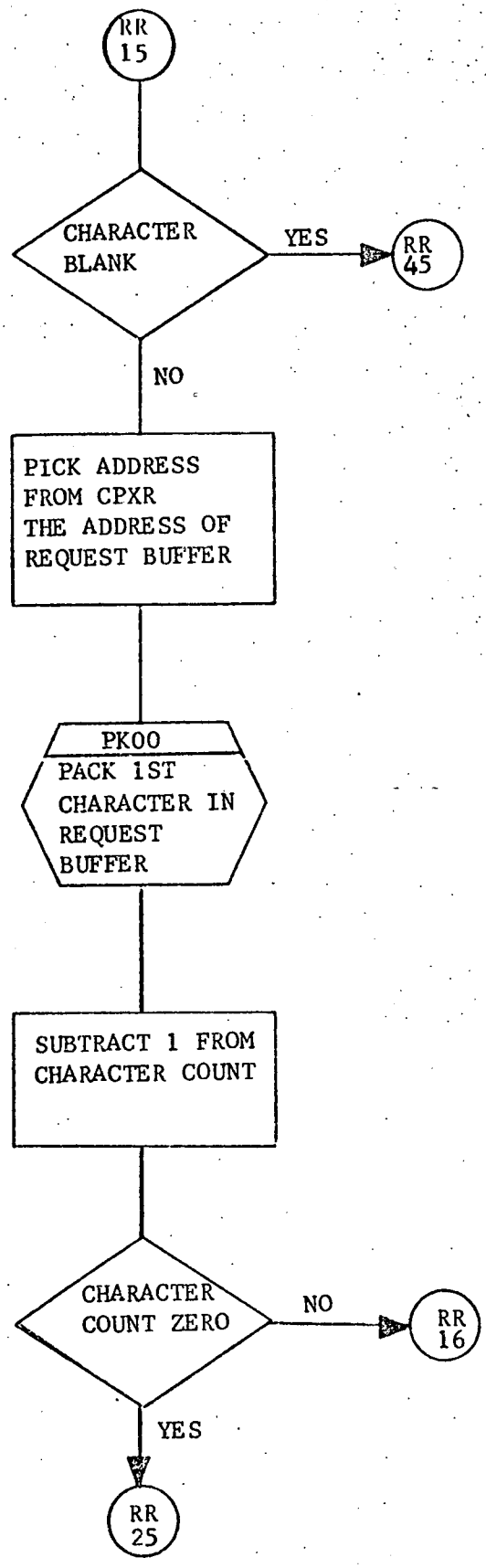
UP00 Subroutine entry used to initialize the impacking of the characters from the temporary Request Buffer

UP01 Subroutine entry used to unpack characters from the temporary Request Buffer

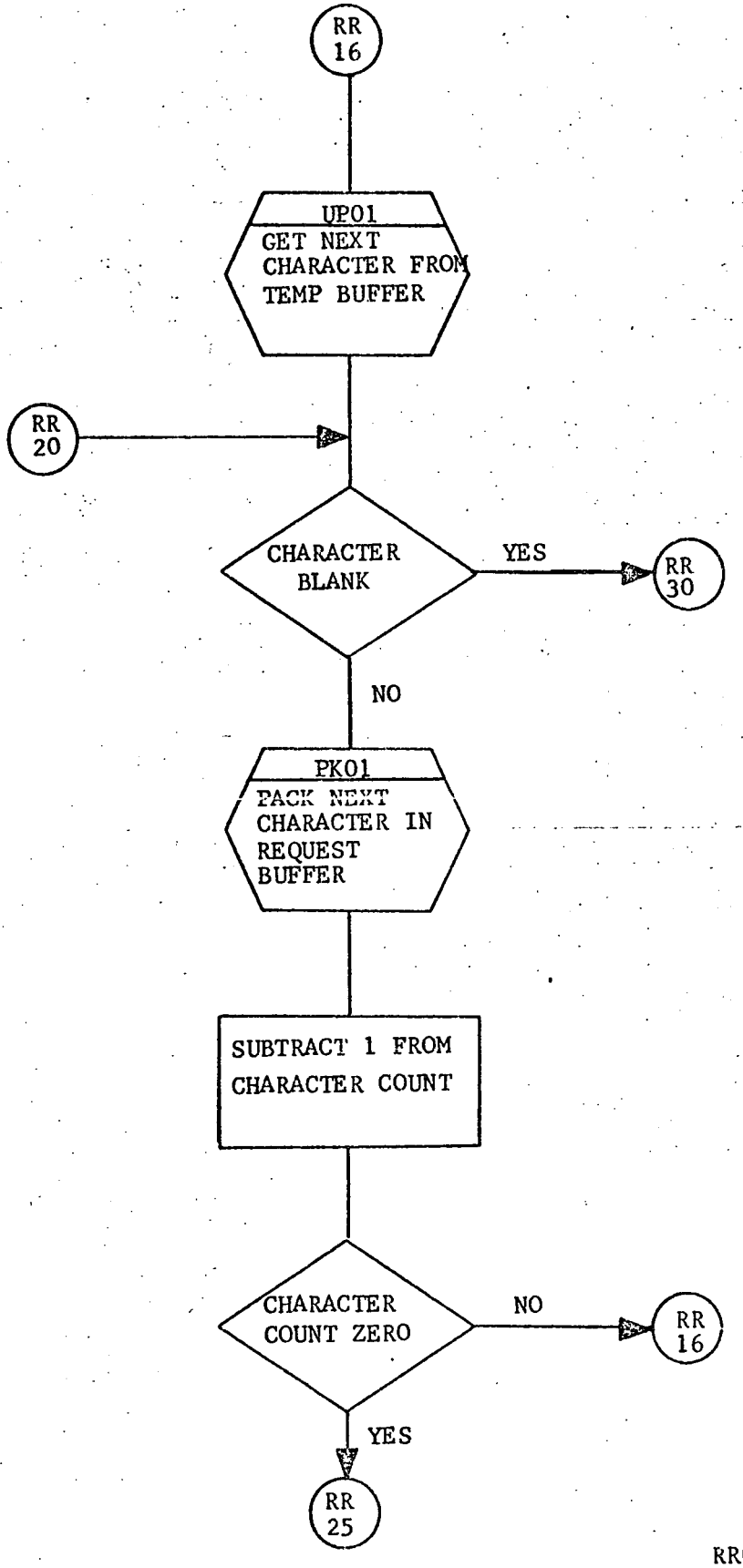
3.3.35.4 Detailed Flow Chart



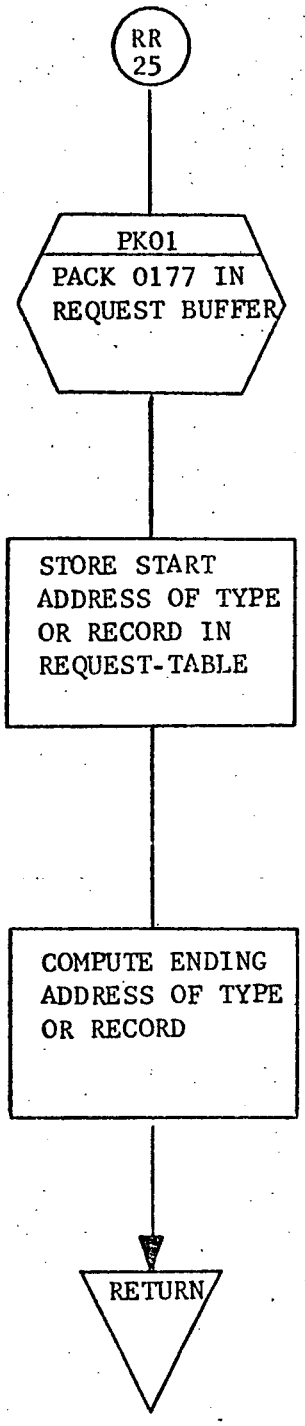
RR00
1 OF 5

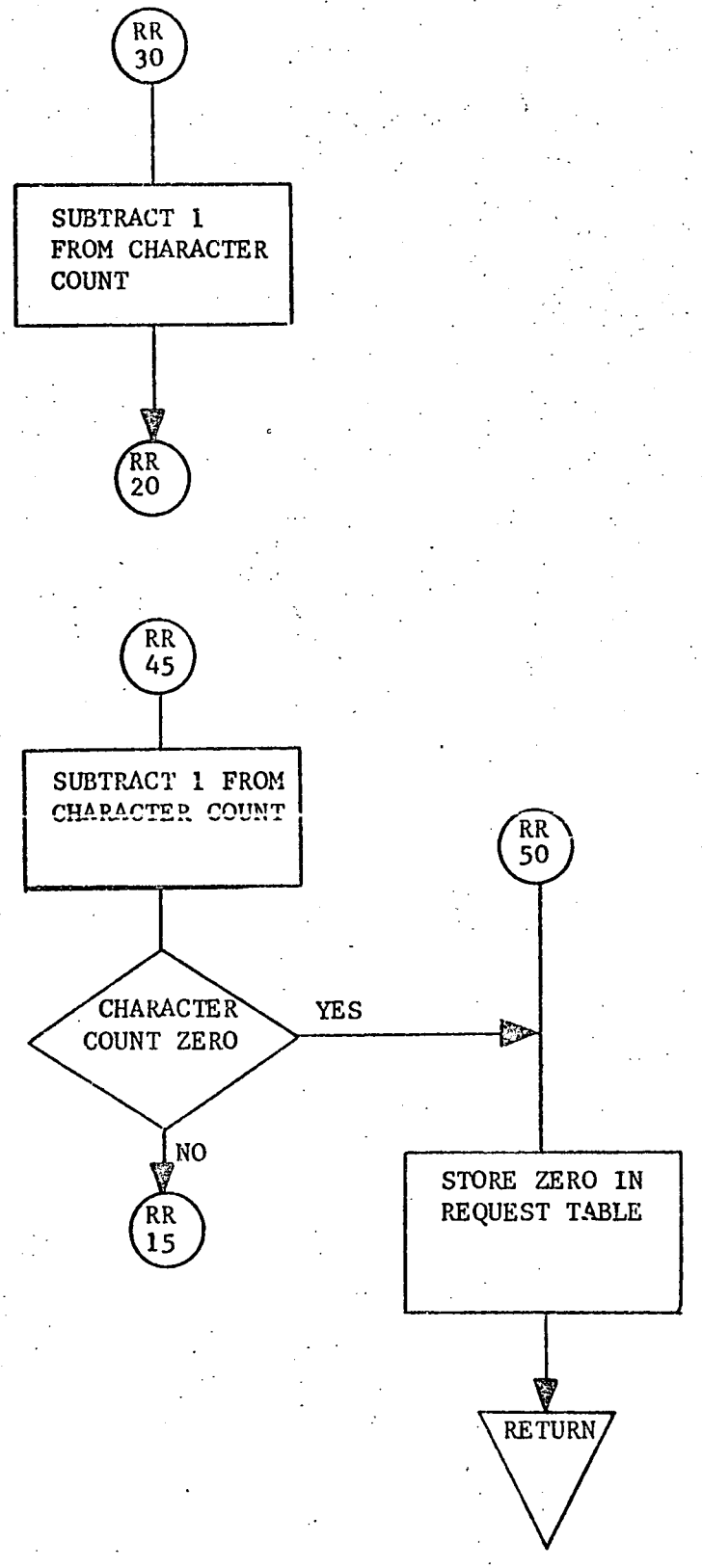

RR
15
CHARACTER
BLANK
YES
RR
45
NO
PICK ADDRESS
FROM CPXR
THE ADDRESS OF
REQUEST BUFFER
PK00
PACK 1ST
CHARACTER IN
REQUEST
BUFFER
SUBTRACT 1 FROM
CHARACTER COUNT
CHARACTER
COUNT ZERO
NO
RR
16
YES
RR
25

RR00
2 OF 5


RR
16
UP01
GET NEXT
CHARACTER FROM
TEMP BUFFER
RR
20
CHARACTER
BLANK
YES
RR
30
NO
PK01
PACK NEXT
CHARACTER IN
REQUEST
BUFFER
SUBTRACT 1 FROM
CHARACTER COUNT
CHARACTER
COUNT ZERO
NO
RR
16
YES
RR
25

RR00
3 OF 5


RR
25
PK01
PACK 0177 IN
REQUEST BUFFER
STORE START
ADDRESS OF TYPE
OR RECORD IN
REQUEST-TABLE
COMPUTE ENDING
ADDRESS OF TYPE
OR RECORD
RETURN


RR 30
SUBTRACT 1 FROM CHARACTER COUNT
RR 20
RR 45
SUBTRACT 1 FROM CHARACTER COUNT
CHARACTER COUNT ZERO
YES
NO
RR 15
RR 50
STORE ZERO IN REQUEST TABLE
RETURN

RROO
5 OF 5

3.3.36 RS00 - Request Social Security Number

3.3.36.1 Purpose

RS00 is a subroutine whose purpose is to edit the Social Security Number and move it from the temporary input buffer to the request buffer.

3.3.36.2 Technical Description

The subroutine edits Social Security Number for 11 digits including dashes. If the Social Security does not meet this criteria, the error message 'INVALID SS-NO' is displayed, the question is decremented and control is returned to RQ00.

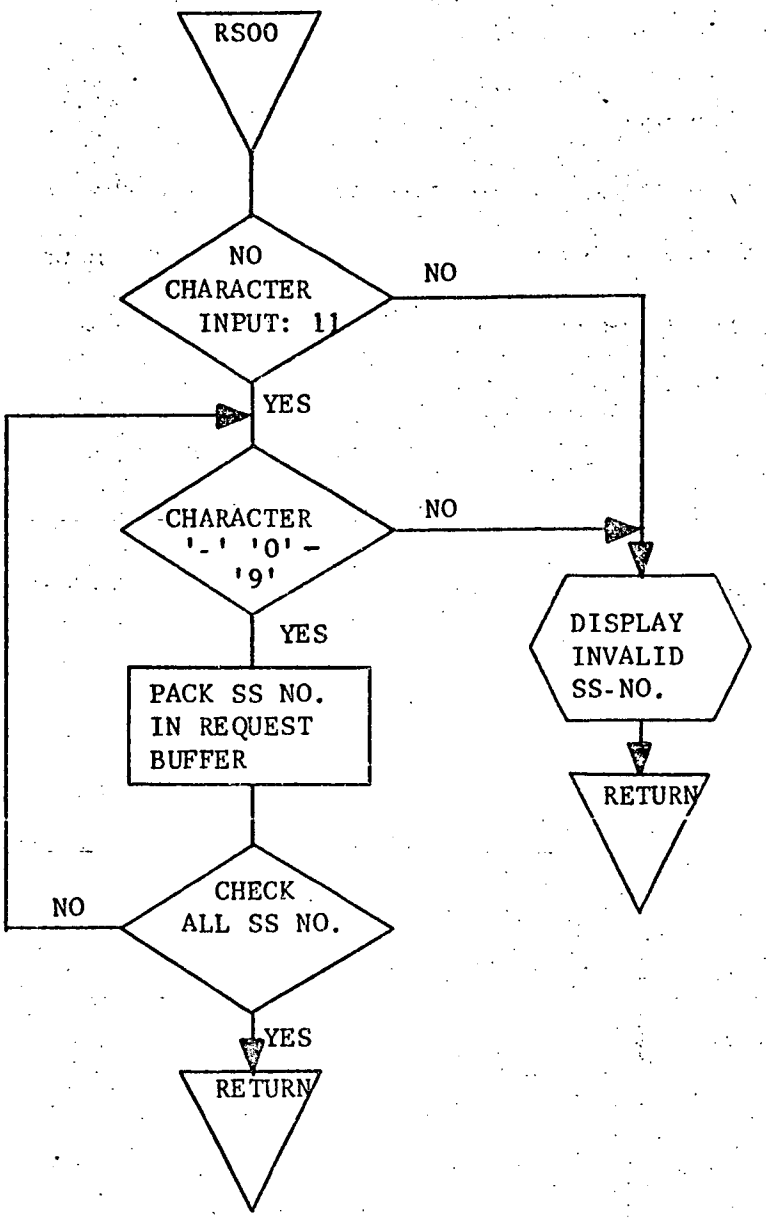
The Social Security Number is moved from the temporary input buffer to the beginning of the request buffer. The first word of the request table (CPRT) is set to the address of the first word of the request buffer (CPRB). The next available address, CPXR is set to the address of the 7th word of CPRB.

3.3.36.2.1 Calling Sequence

CALL RS00

REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	N/A	Modified
B	N/A	Modified
X	N/A	Modified
Overflow	N/A	Same

3.3.36.2.2 General Flow Chart



3.3.36.3 Label Description

3.3.36.3.1 Local

None

3.3.36.3.2 Global

RSMK 7 bit mask used to mask out ASCII code. The subroutine RR00 also uses it as a mask.

3.36.3.3 Entry Point

RS00

3.3.36.3.4 External References

CPRB Defined in CR00, Request Buffer

CPRT Defined in CP00, Request Table

CPSW Defined in CP00, contains number of characters input

CPXR Defined in CP00, next available address in Request Buffer

ER00 Subroutine called to output error message

PK00 Subroutine entry used to initialize the pack of the Request Buffer

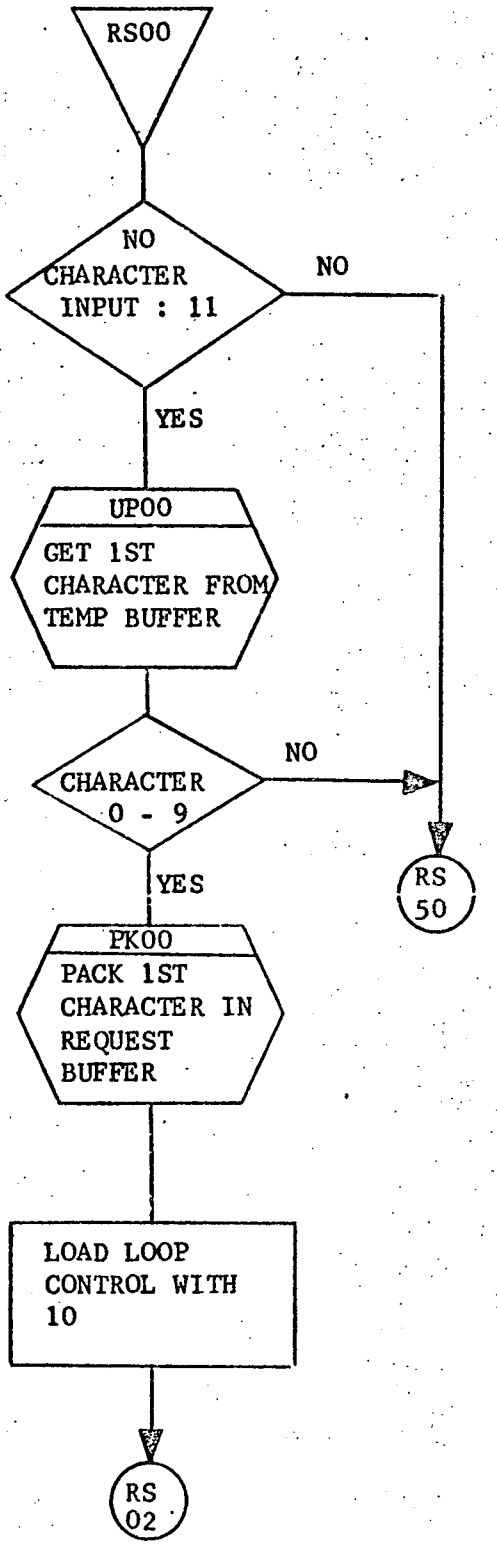
PK01 Subroutine entry used to pack the Request Buffer

RQTB Defined in RQ00, Temporary Input Buffer

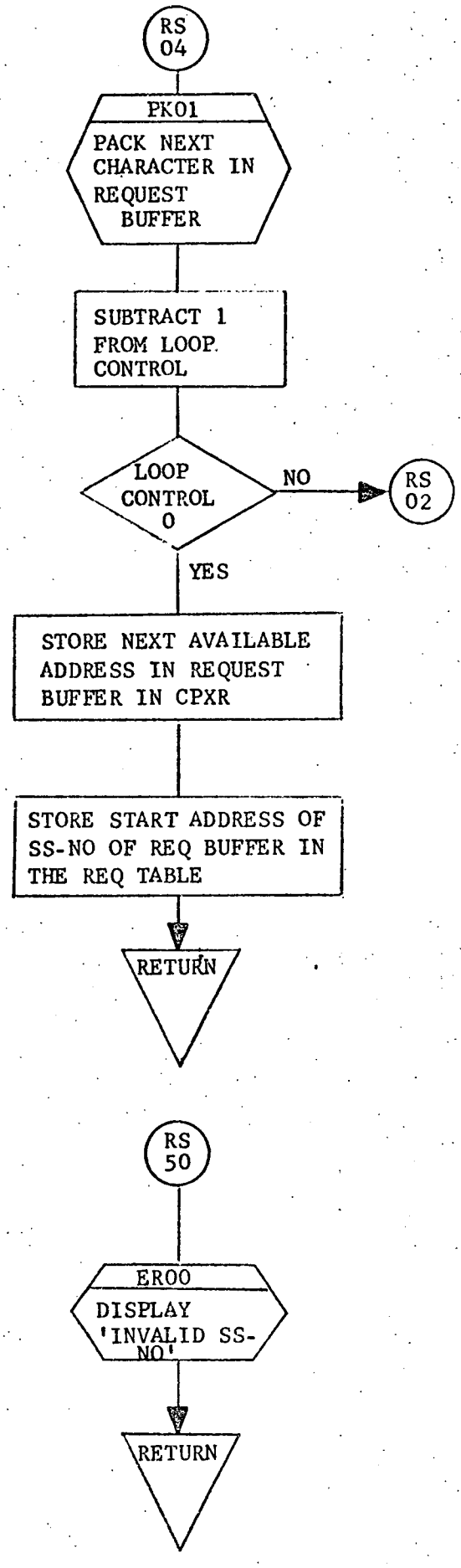
UP00 Subroutine entry used to initialize the unpacking of the Temporary Input Buffer

UP01 Subroutine entry used to unpack the Temporary Input Buffer

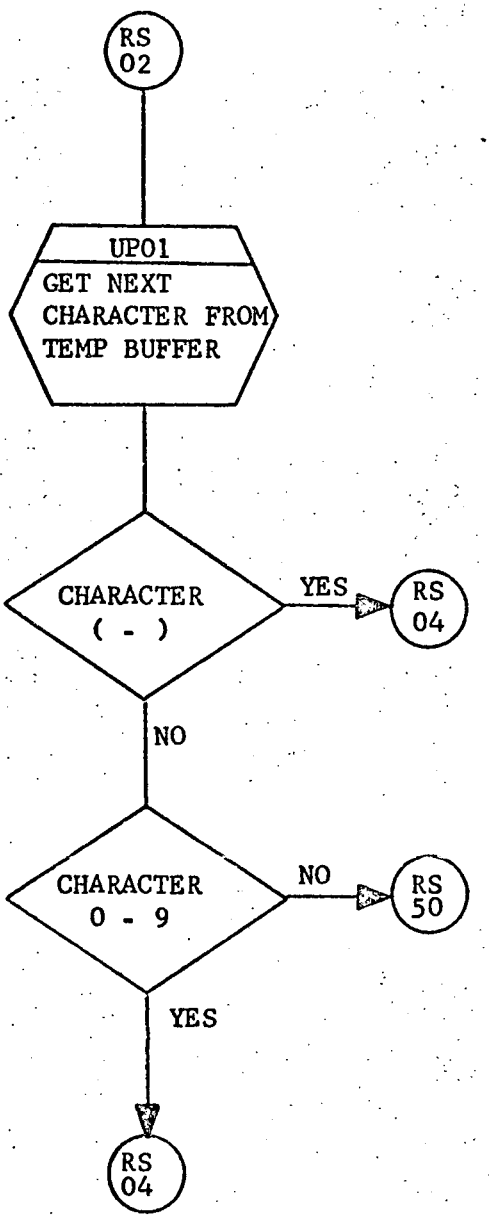
3.3.36.4 Detailed Flow Chart



RS00
1 OF 3


RS 04
PK01
PACK NEXT CHARACTER IN REQUEST BUFFER
SUBTRACT 1 FROM LOOP CONTROL
LOOP CONTROL 0
NO
RS 02
YES
STORE NEXT AVAILABLE ADDRESS IN REQUEST BUFFER IN CPXR
STORE START ADDRESS OF SS-NO OF REQ BUFFER IN THE REQ TABLE
RETURN
RS 50
ER00
DISPLAY 'INVALID SS-NO'
RETURN

RS00
2 OF 3


RS
02
UP01
GET NEXT
CHARACTER FROM
TEMP BUFFER
CHARACTER
(-)
YES
RS
04
NO
CHARACTER
0 - 9
NO
RS
50
YES
RS
04

RS00
3 OF 3

3.3.37 SE00 - System Error

3.3.37.1 Purpose

The purpose of this subroutine is to output an error message to the system input/output device, the teletype.

3.3.37.2 Technical Description

Error messages are precoded and a table of pointers (SETB) can be indexed to access the beginning locations of each message buffer. The appropriate message may then be output through a call to IS90. All messages are twelve words (24 characters) in length. The calling routine passes off the number of the error message to be output which is used as the index into the pointer table.

3.3.37.2.1 Calling Sequence

CALL SE00

REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	N/A	N/A
B	N/A	N/A
X	number of error message to be output	N/A
Overflow	N/A	N/A

3.3.37.2.2 General Flow Chart

See Section 3.3.37.4

3.3.37.3 Label Description

3.3.37.3.1 Local

SENC - (24) the number of characters in each error message.

SETB - (SE10, SE11, SE12) table of pointers to beginning locations of each error message buffer.

SE10 - (carriage return, line feed, "PARITY ERROR", carriage return, line feed)

SE11 - (carriage return, line feed, "MODEM DISCONNECTED", carriage return, line feed)

SE12 - (carriage return, line feed, "CRT NOT READY", carriage return, line feed)

3.3.37.3.2 Global

None

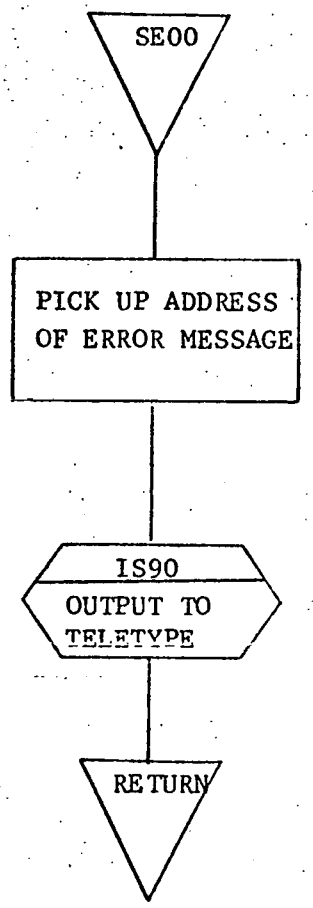
3.3.37.3.3 Entry Points

SE00

3.3.37.3.4 External References

IS90 - output handler to system input/output device, the teletype.

3.3.37.4 Detailed Flow Chart



3.3.38 TA00 - Tabulate and Analyze

3.3.38.1 Purpose

TA00 is a subroutine whose purpose is to tabulate or analyze those parameters specified in a Retrieval Request and then output those values in an ordered sequence.

3.3.38.2 Technical Description

TA00 initially collects all user specified WHAT headings which are to be tabulated or analyzed and outputs those in the form of a heading line. Six headings are allowed for a line being output to Teletype while only two headings are allowed per CRT line. After all headings have been output, MATCH WHAT is called to check for matches between the current tape record and the Retrieval Request WHAT parameter. If a match is found, the data is moved to a print buffer. Four types of data are possible: heading with no answer, heading with alpha answer, heading with numeric answer, and heading with a range of numeric data. If the tabulate action is requested, all numeric data is collected and stored for future use in calculating the Mean and Standard Deviation. The formulae used in calculating those are as follows:

The Mean of N numbers

$$\text{Mean} = \sum_{i=1}^{N} X_i \Big/ N$$

The Standard Deviation of N numbers

$$\text{S.D.} = \sqrt{\frac{N\sum_{i=1}^{N} X_i^2 - \left(\sum_{1=1}^{N} X_i\right)^2}{N(N-1)}}$$

For each WHAT heading answer, an associated social security number and date are shown with the data. A sample analyze request is shown below. The tabulate request would be identical except for an omission of the Mean and Standard Deviation lines.

		HEIGHT	WEIGHT
123-45-6789	01JAN68	71	160
234-56-7890	10MAR68	68.5	150
345-67-8901	30MAR68	69	170
	MEAN	69.5	160
	SD	2.33	9.85

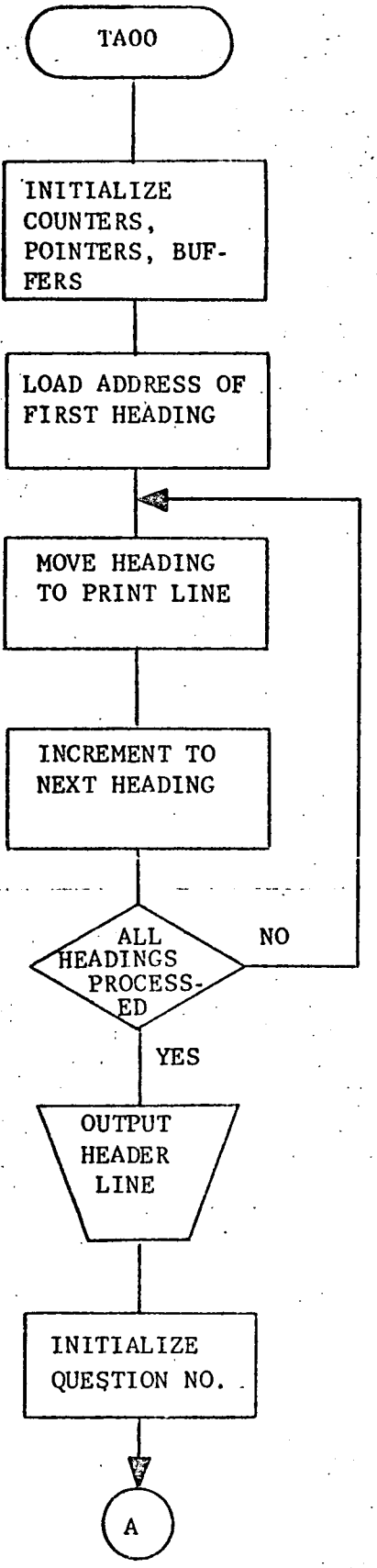
3.3.38.2.1 Calling Sequence

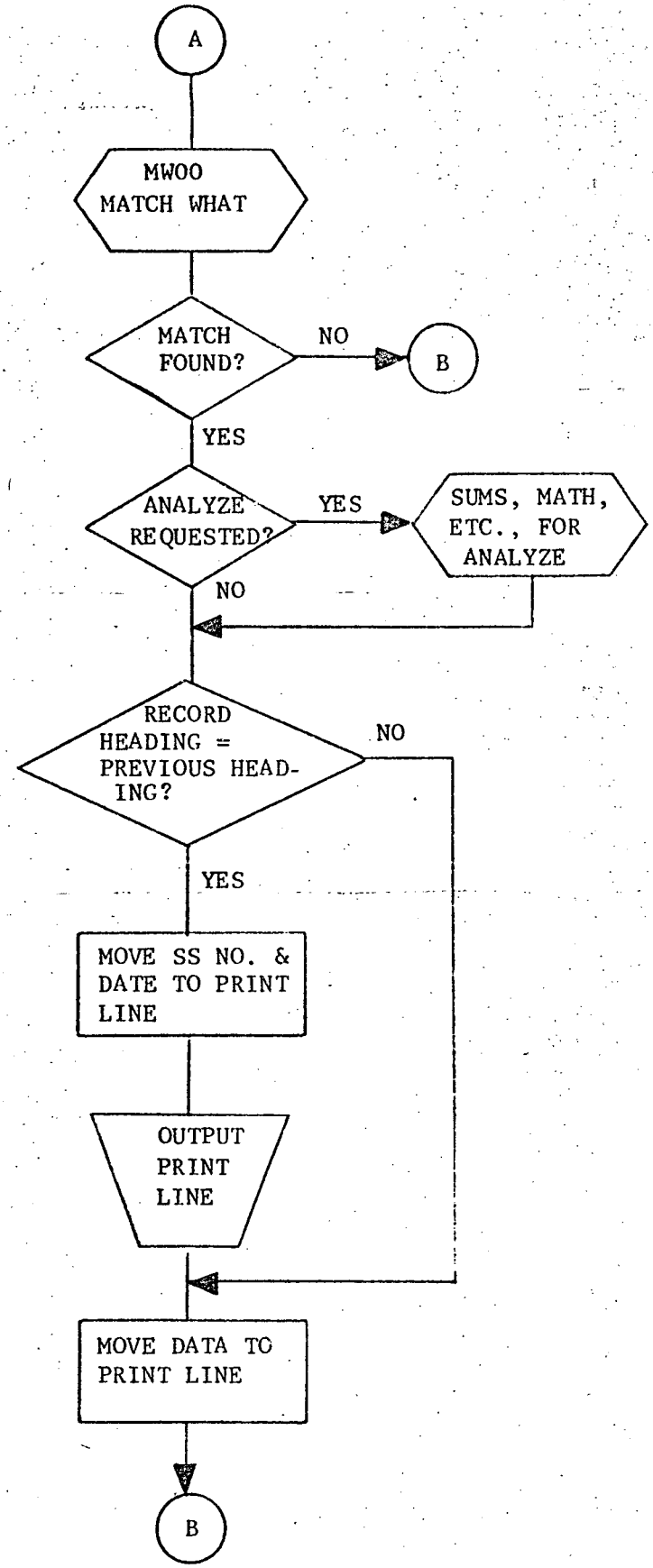
CALL TA00 (for all data values to be output)

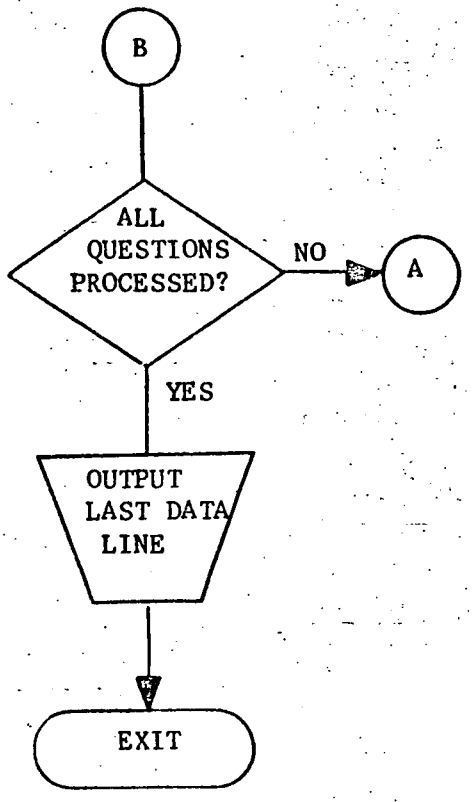
CALL TAA1 (for outputting of the Mean and Standard Deviation)

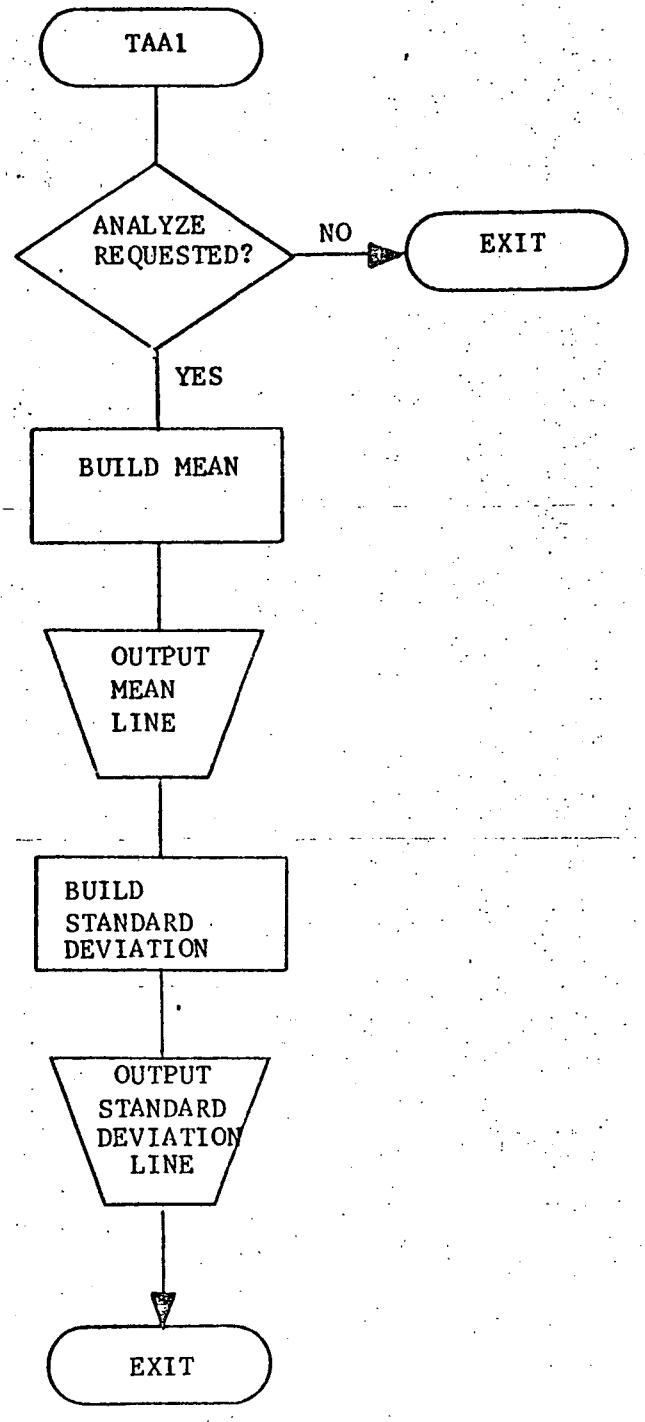
REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	Saved upon entry	Restored upon exit
B	Saved upon entry	Restored upon exit
X	Saved upon entry	Restored upon exit
Overflow	N/A	N/A

3.3.38.2.2 General Flow Chart




A
MWOO
MATCH WHAT
MATCH
FOUND?
NO
B
YES
ANALYZE
REQUESTED?
YES
SUMS, MATH,
ETC., FOR
ANALYZE
NO
RECORD
HEADING =
PREVIOUS HEAD-
ING?
NO
YES
MOVE SS NO. &
DATE TO PRINT
LINE
OUTPUT
PRINT
LINE
MOVE DATA TO
PRINT LINE
B


B
ALL QUESTIONS PROCESSED?
NO
A
YES
OUTPUT LAST DATA LINE
EXIT


TAA1
ANALYZE REQUESTED?
NO
EXIT
YES
BUILD MEAN
OUTPUT MEAN LINE
BUILD STANDARD DEVIATION
OUTPUT STANDARD DEVIATION LINE
EXIT

3.3.38.3 Label Description

3.3.38.3.1 Local

TAAD a ten word table containing values by which headings are to be biased in the output buffer.

TABF temporary storage location for the contents of the 61 word print output buffer

TABL nine word table used to flag headings which have been processed and are ready to be output

TACR individual data field output character count

TACW storage location which contains the status of the I/O function being performed

TAFG flag which is set whenever a line of data has been output

TAFL heading location indicator

TANC a seven word table used to store sums, squares, etc.

TAOP operand buffer index counter

TAPU flag which is set whenever a header line has been output

TAQN storage location containing the number of the question being processed

TASA temporary storage location for the contents of the A-register

TASB temporary storage location for the contents of the B-register

TASS an eighteen word table used to store sums of squared data values which will be used in the Standard Deviation calculations

TASW storage location which contains the status of the I/O function being performed

TASX temporary storage location for the contents of the X-register

TAUC storage location which is used to keep count of the number of characters outpu for a particular heading. A maximum of eight characters are allowed per heading.

3.3.38.3.1 Local (Continued)

TAXC a nine word table used to store various integer values that are to be converted to floating point at a later time.

TAXG flag which is set whenever data has been found for a particular parameter

TAXI an eighteen word table used to store sums of numbers which will be used in the Standard Deviation calculations

TAXS a two word buffer used to store miscellaneous floating point data values

TAXX storage location for the contents of the X-register

3.3.38.3.2 Global

TAPU flag which is set whenever a header line has been output

3.3.38.3.3 Entry Points

TA00 - primary entry point

TAA1 - entry point to the routine which calculates and outputs the Mean and Standard Deviation

3.3.38.3.4 External References

3.3.38.3.4.1 External Labels

CPRT starting address of the seven word Request Table

CPTB starting address of the Tape Input Buffer

MAS1 switch which is set if any matched data has been found on the master

3.3.38.3.4.1 External Labels (Continued)

MATC	storage location which contains the number of coded data characters found in an answer area
MATE	storage location which signifies where the decimal is to be placed in a fractional number
MATM	starting address of the buffer where the answer data is stored
MATS	storage location which contains the sign of the numeric data being processed (0-positive, 1-negative)
MWFG	a storage location containing the tape question number currently being processed
MWXP	a storage location containing the beginning address of the WHAT Table
PKSW	switch which controls into which half of a data word a character is to be put

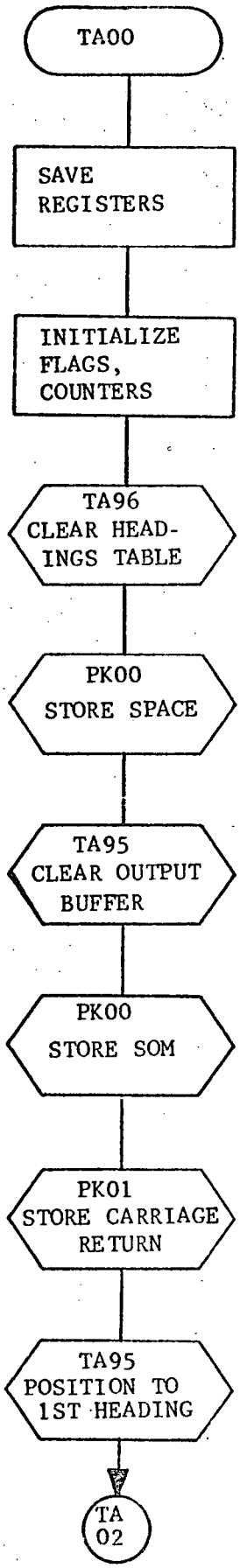
3.3.38.3.4.2 External Subroutines

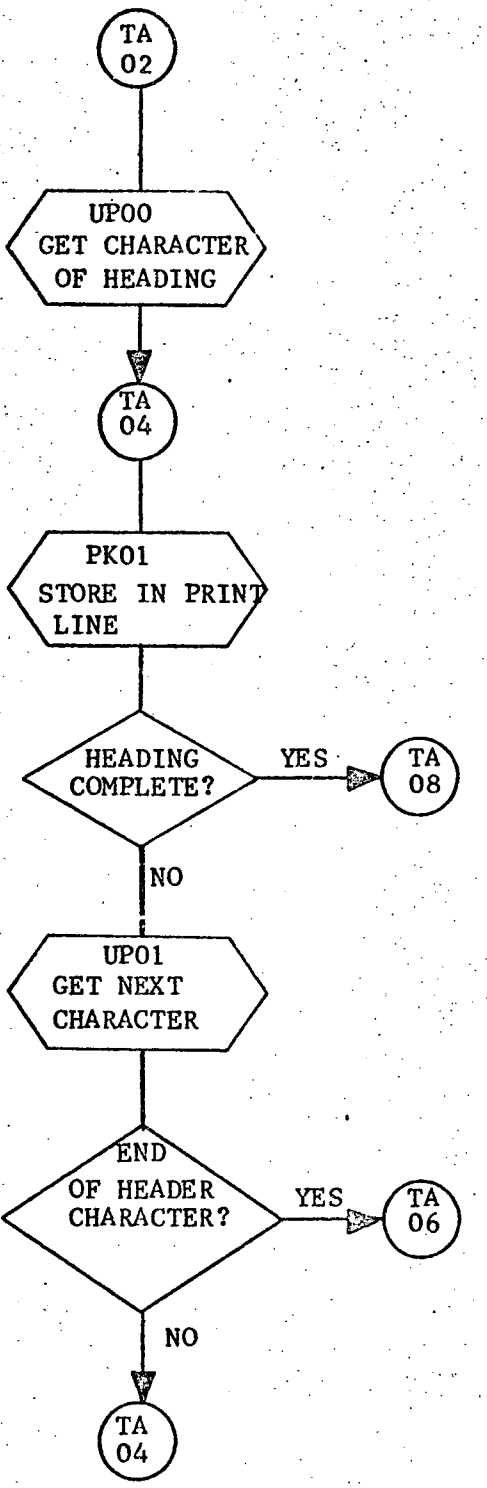
CD00	Convert and Store Month
FA00	Floating Point to ASCII Conversion
FL00	ASCII to Floating Point Conversion
MAB0	Find Matched Data Routine
MW00	Match WHAT Routine
OM00	Output Header/Data Line
PK00	Pack Character
SQRT	Square Root Calculation
UP00	Unpack Character
$QK	Floating Point Add

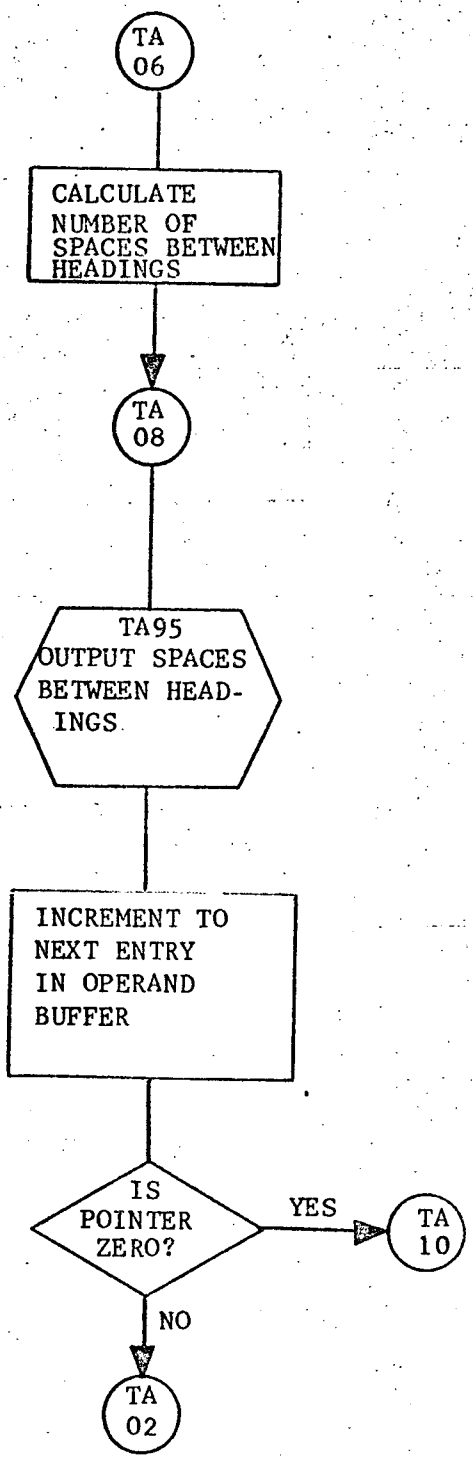
3.3.38.3.4.2 External Subroutines (Continued)

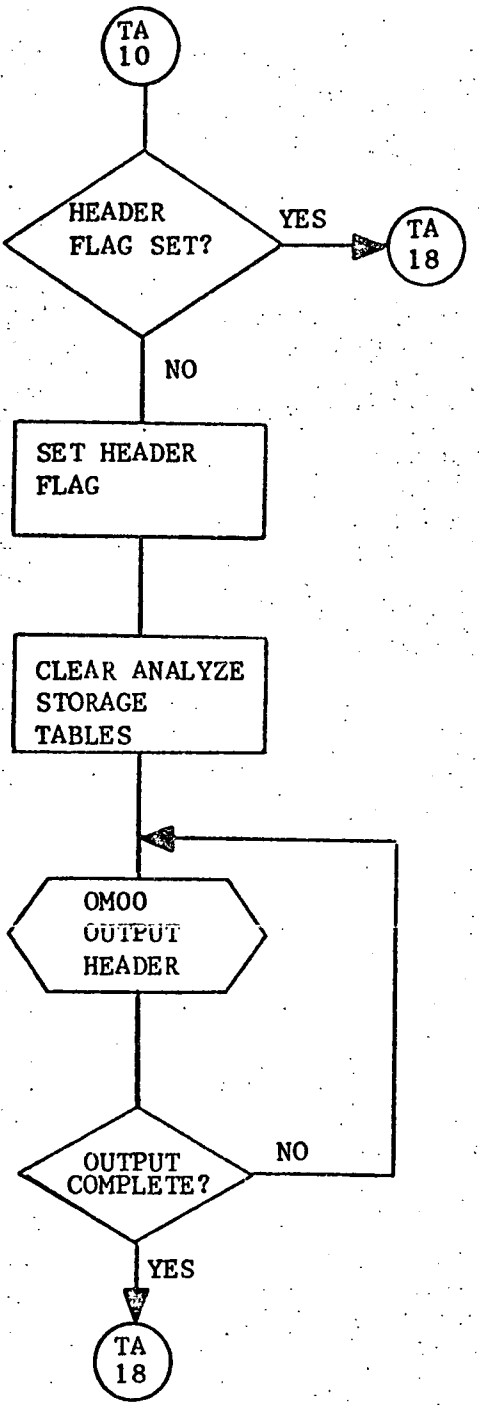
$QL	Floating Point Subtract
$QM	Floating Point Multiply
$QN	Floating Point Divide
$QS	Integer to Floating Point Conversion

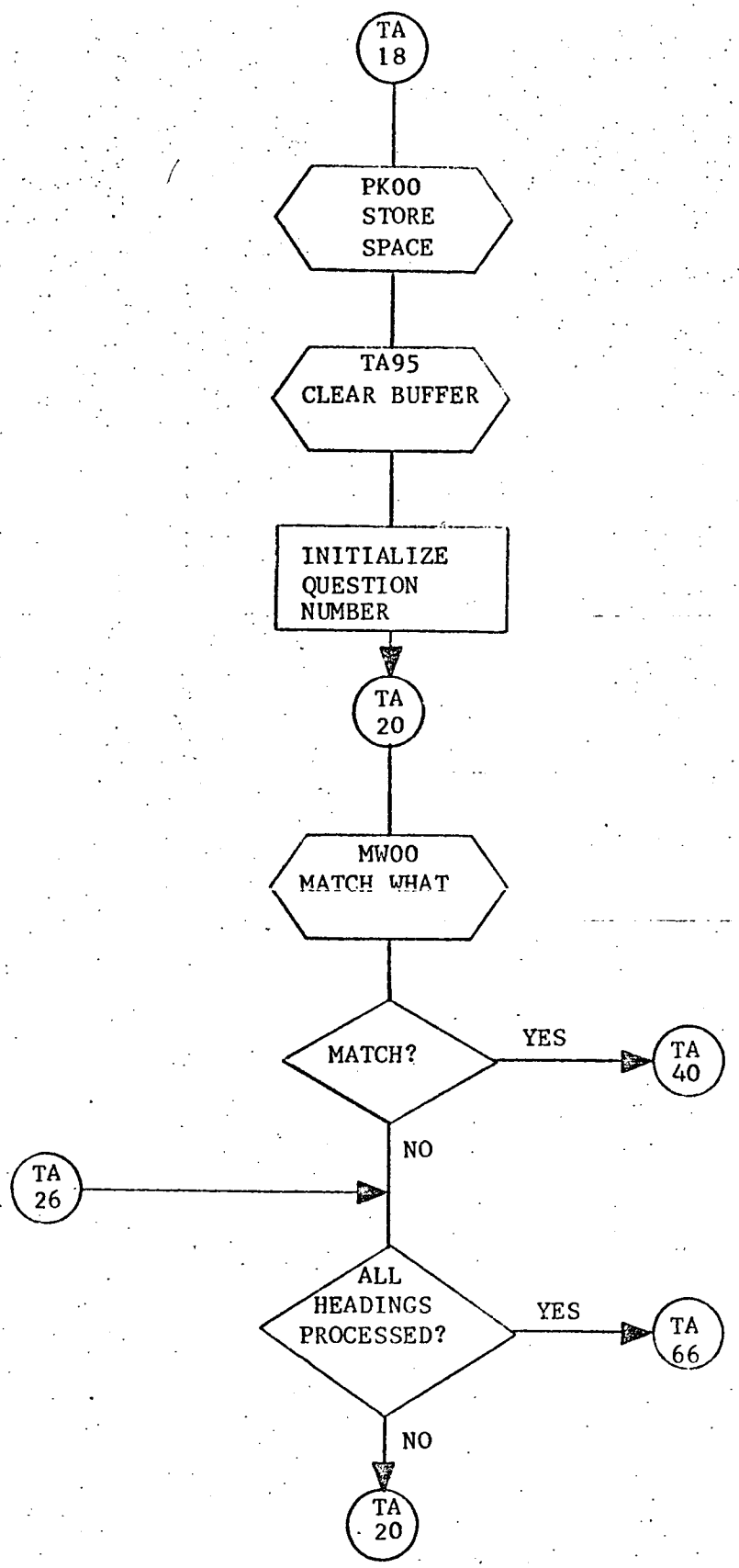
3.3.38.4 DETAILED FLOW CHART



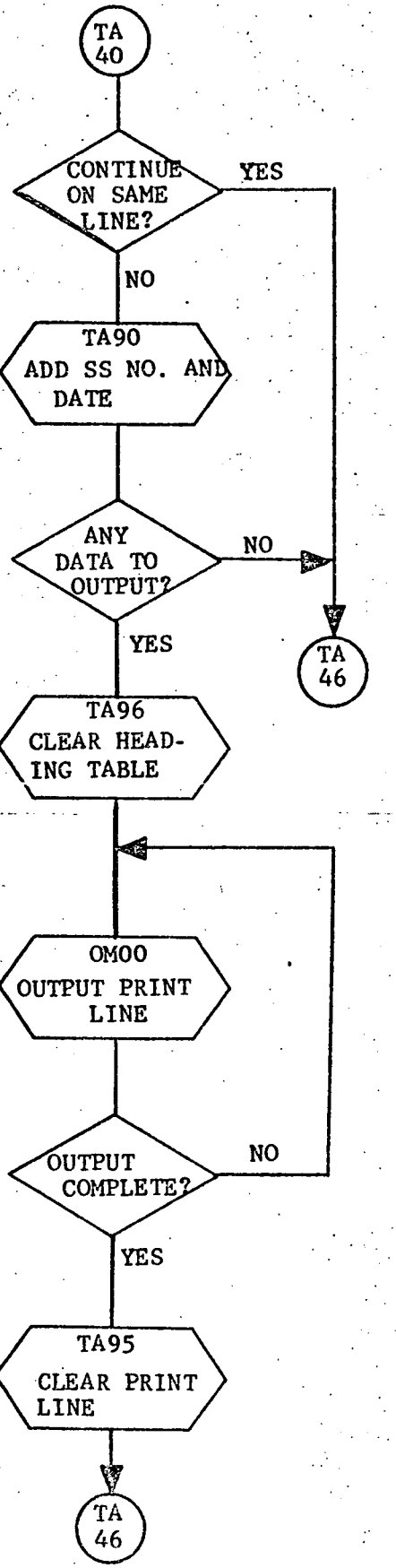

TA
02
UP00
GET CHARACTER
OF HEADING
TA
04
PK01
STORE IN PRINT
LINE
HEADING
COMPLETE?
YES
TA
08
NO
UP01
GET NEXT
CHARACTER
END
OF HEADER
CHARACTER?
YES
TA
06
NO
TA
04

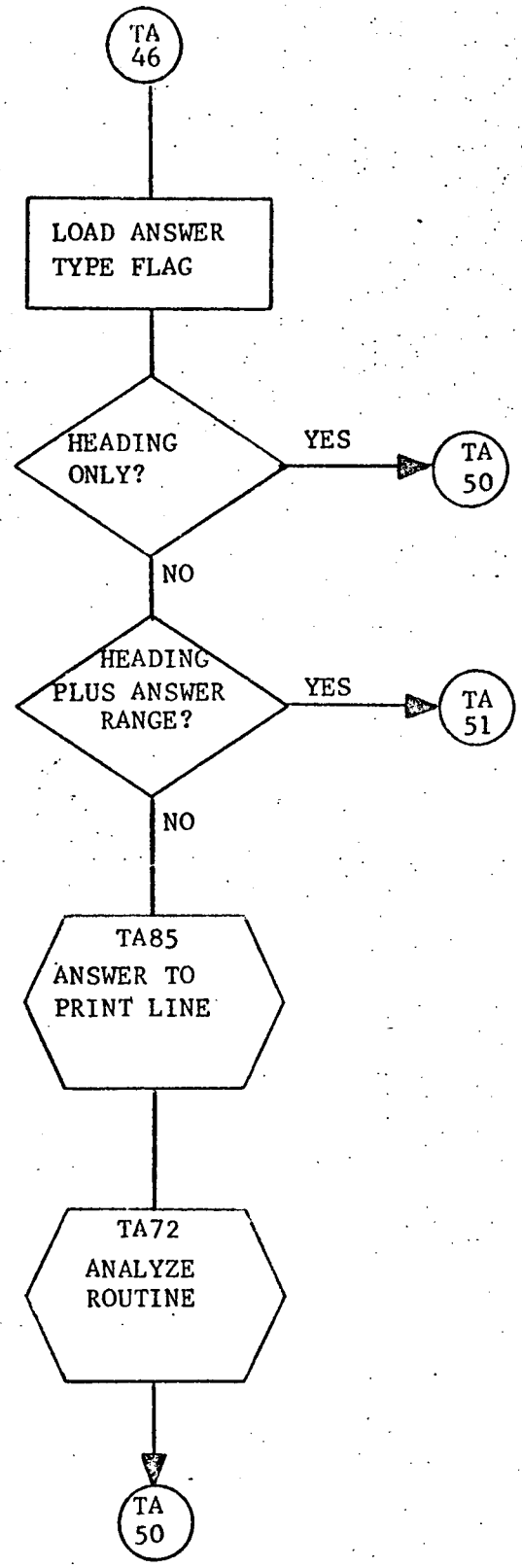

TA
06
CALCULATE
NUMBER OF
SPACES BETWEEN
HEADINGS
TA
08
TA95
OUTPUT SPACES
BETWEEN HEAD-
INGS
INCREMENT TO
NEXT ENTRY
IN OPERAND
BUFFER
IS
POINTER
ZERO?
YES
TA
10
NO
TA
02

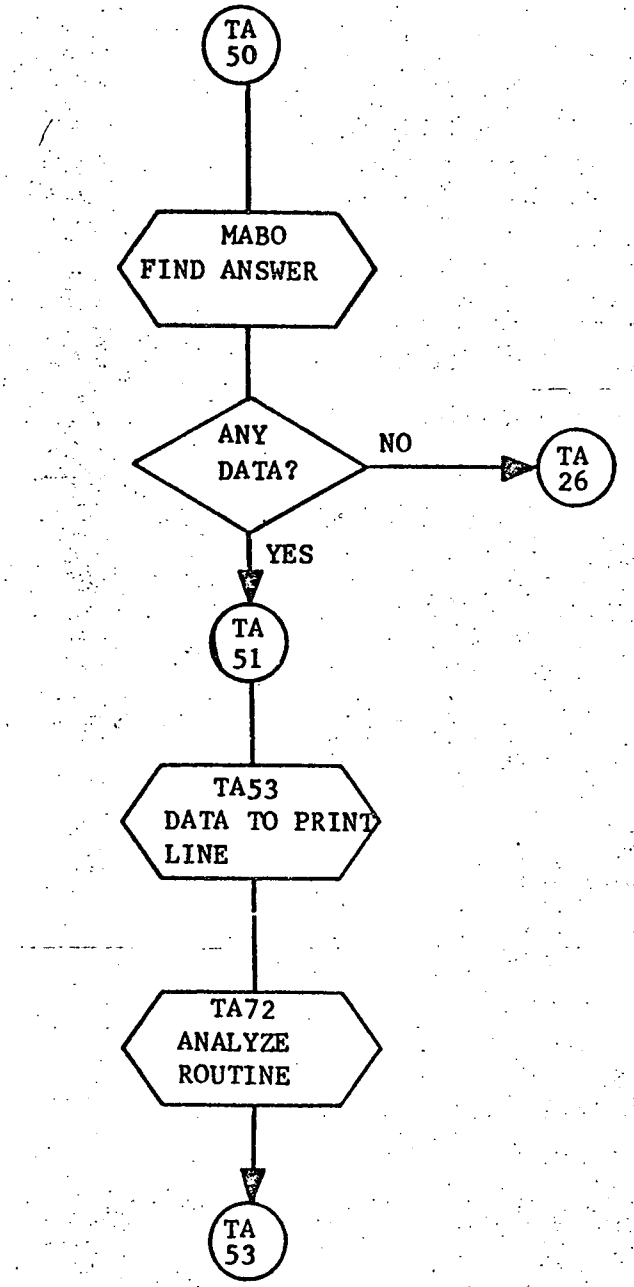

TA
10
HEADER
FLAG SET?
YES
TA
18
NO
SET HEADER
FLAG
CLEAR ANALYZE
STORAGE
TABLES
OM00
OUTPUT
HEADER
OUTPUT
COMPLETE?
NO
YES
TA
18

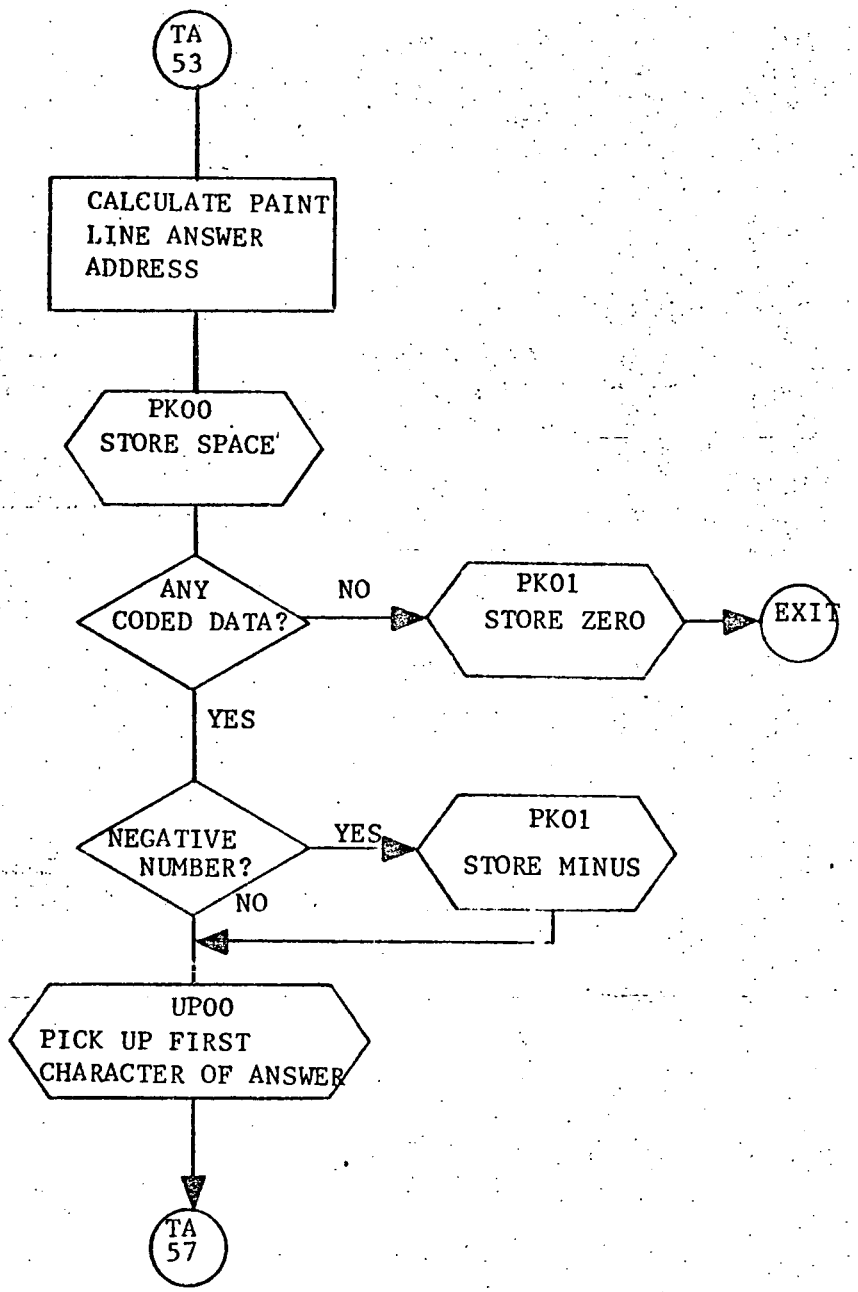

TA 18
PK00 STORE SPACE
TA95 CLEAR BUFFER
INITIALIZE QUESTION NUMBER
TA 20
MW00 MATCH WHAT
MATCH?
YES
TA 40
NO
TA 26
ALL HEADINGS PROCESSED?
YES
TA 66
NO
TA 20

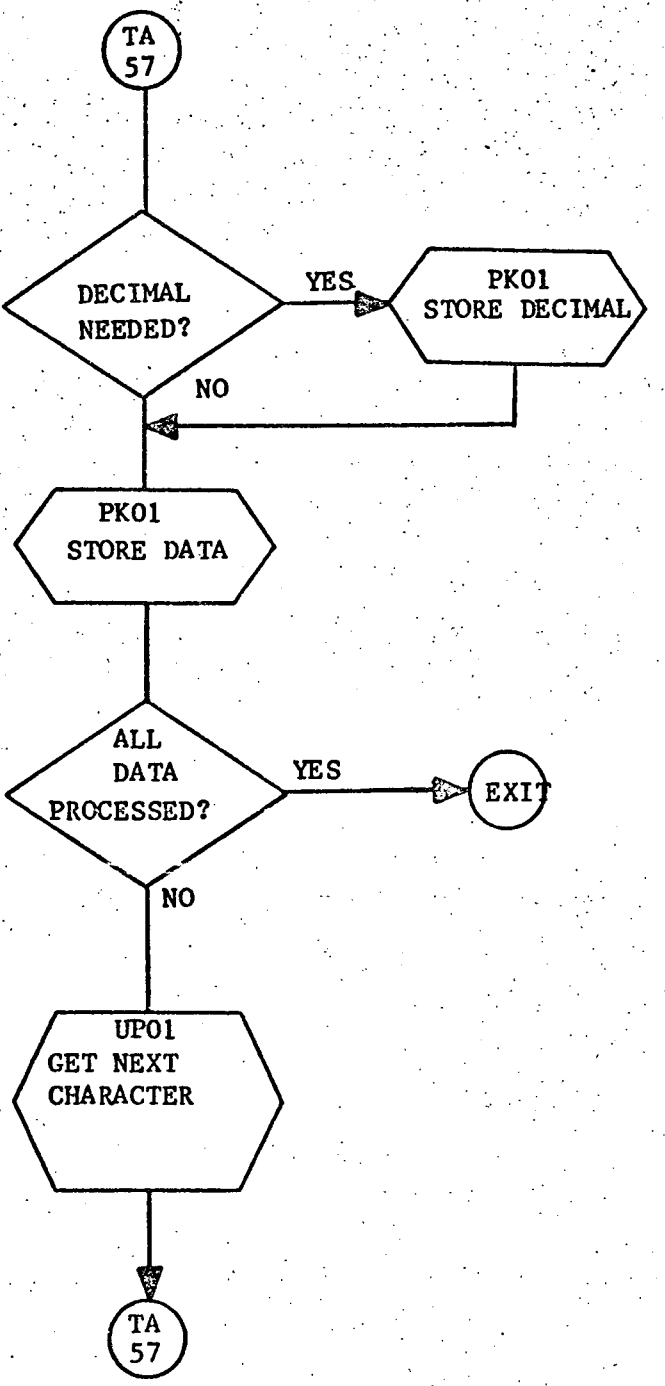
90

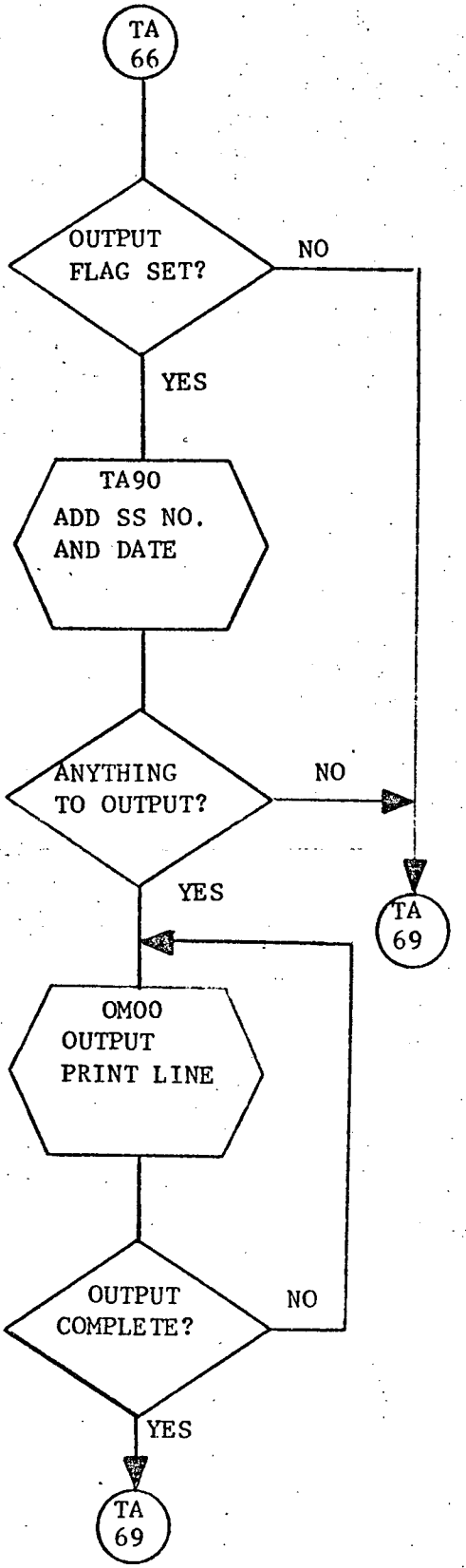

TA
40
CONTINUE
ON SAME
LINE?
YES
NO
TA90
ADD SS NO. AND
DATE
ANY
DATA TO
OUTPUT?
NO
YES
TA
46
TA96
CLEAR HEAD-
ING TABLE
OM00
OUTPUT PRINT
LINE
OUTPUT
COMPLETE?
NO
YES
TA95
CLEAR PRINT
LINE
TA
46

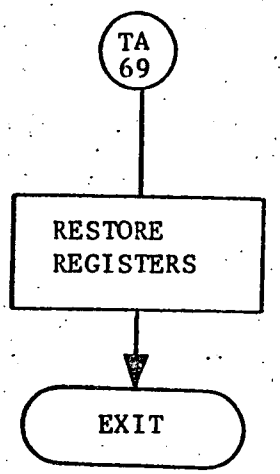

TA
46
LOAD ANSWER
TYPE FLAG
HEADING
ONLY?
YES
TA
50
NO
HEADING
PLUS ANSWER
RANGE?
YES
TA
51
NO
TA85
ANSWER TO
PRINT LINE
TA72
ANALYZE
ROUTINE
TA
50

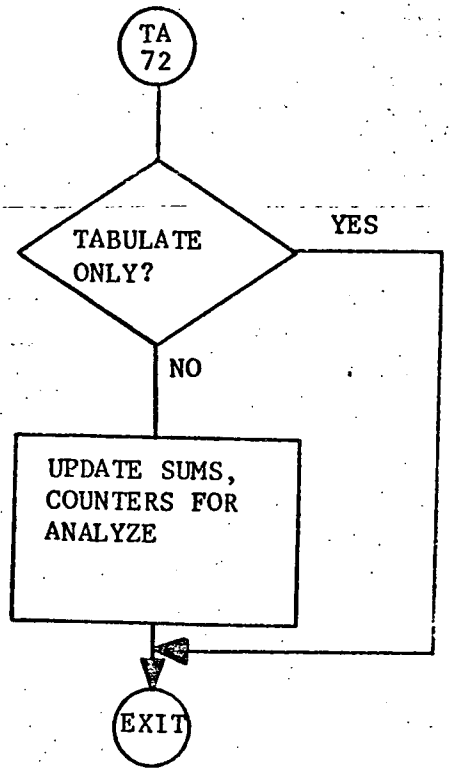

TA
50
MABO
FIND ANSWER
ANY
DATA?
NO
TA
26
YES
TA
51
TA53
DATA TO PRINT
LINE
TA72
ANALYZE
ROUTINE
TA
53

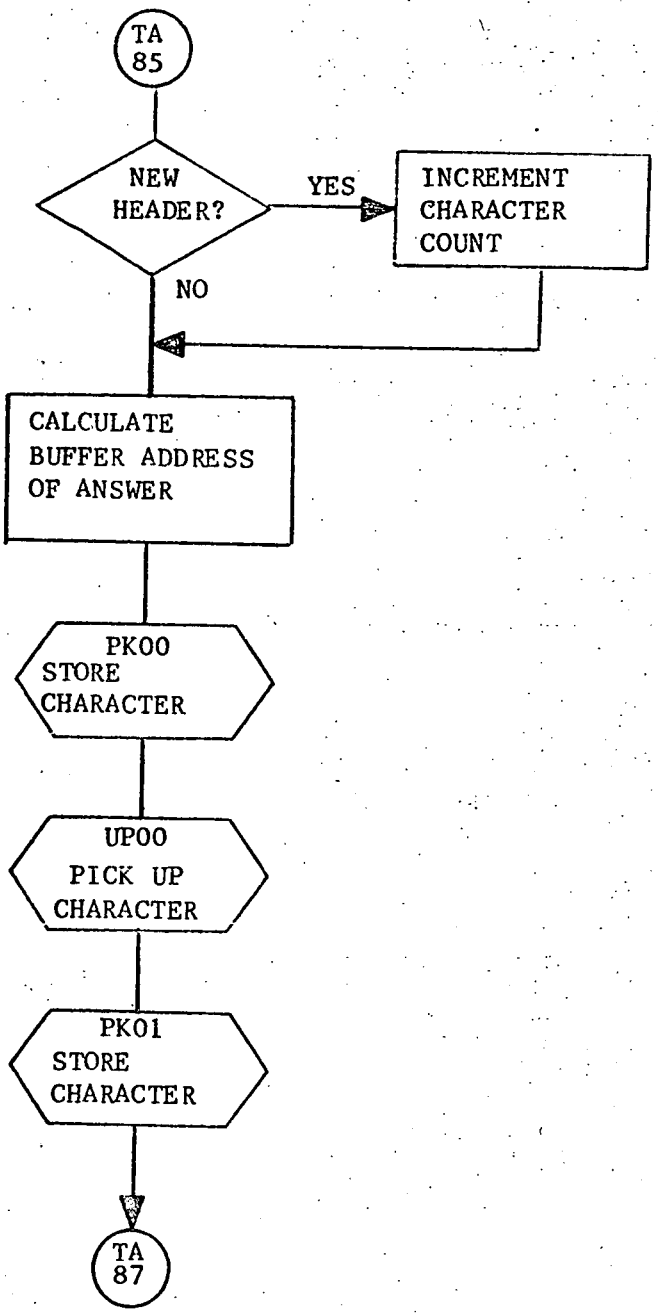

TA
53
CALCULATE PAINT
LINE ANSWER
ADDRESS
PK00
STORE SPACE
ANY
CODED DATA?
NO
PK01
STORE ZERO
EXIT
YES
NEGATIVE
NUMBER?
YES
PK01
STORE MINUS
NO
UP00
PICK UP FIRST
CHARACTER OF ANSWER
TA
57

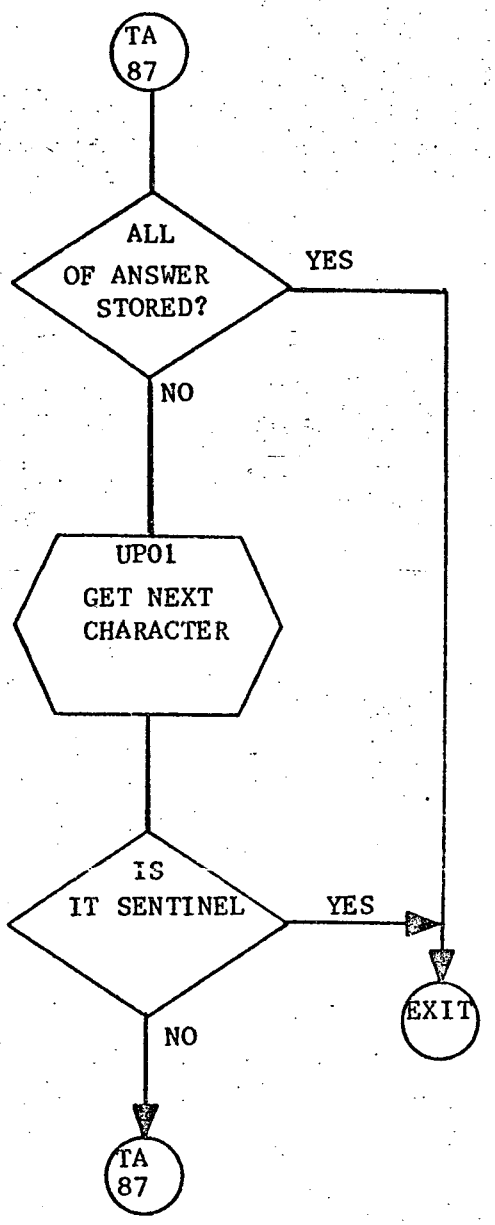

TA
57
DECIMAL
NEEDED?
YES
PK01
STORE DECIMAL
NO
PK01
STORE DATA
ALL
DATA
PROCESSED?
YES
EXIT
NO
UP01
GET NEXT
CHARACTER
TA
57

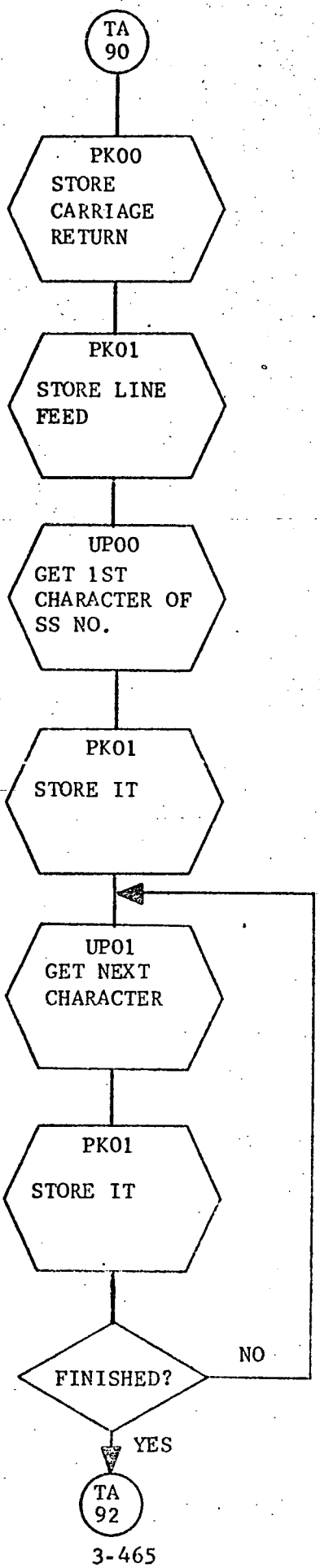

TA
66
OUTPUT
FLAG SET?
NO
YES
TA90
ADD SS NO.
AND DATE
ANYTHING
TO OUTPUT?
NO
YES
TA
69
OMOO
OUTPUT
PRINT LINE
OUTPUT
COMPLETE?
NO
YES
TA
69

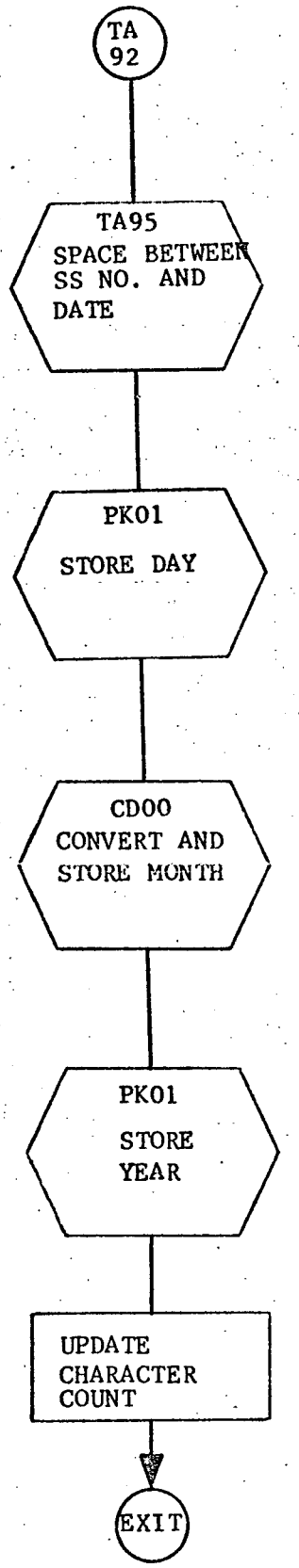

TA
69
RESTORE
REGISTERS
EXIT

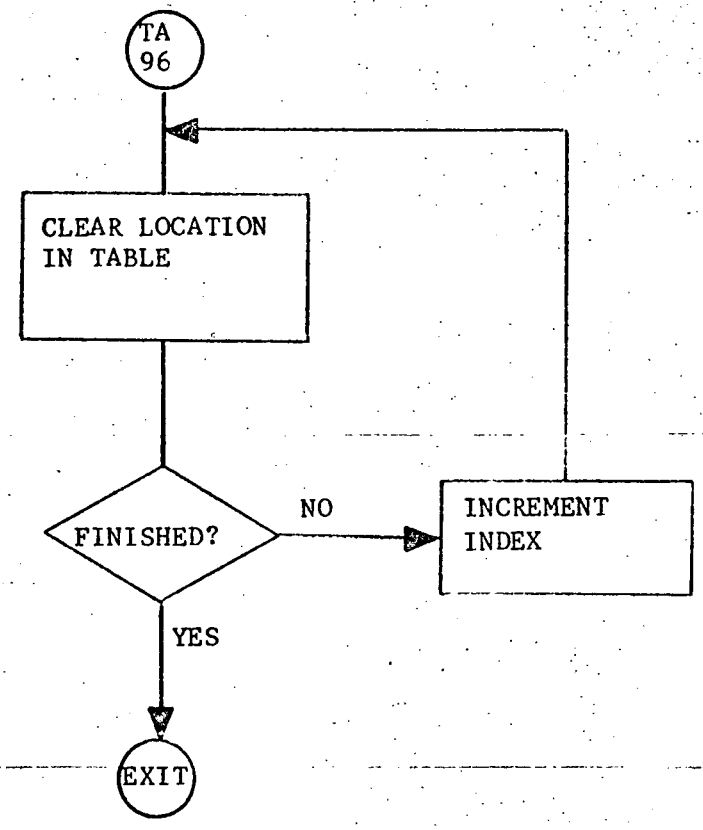

TA
72
TABULATE
ONLY?
YES
NO
UPDATE SUMS,
COUNTERS FOR
ANALYZE
EXIT

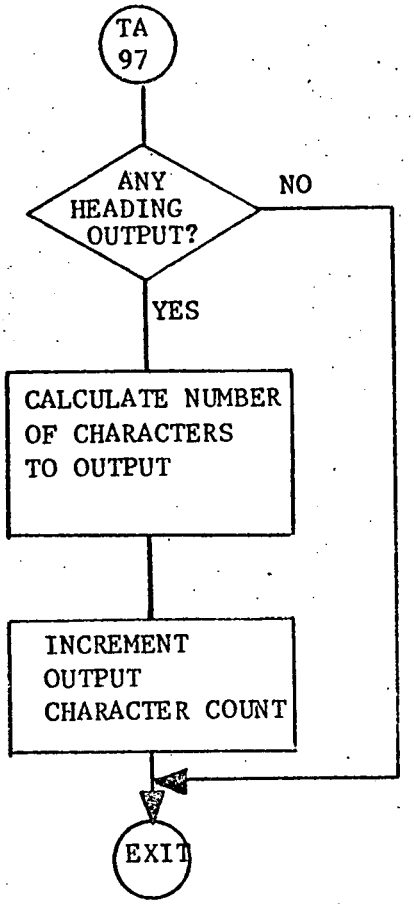

TA
85
NEW
HEADER?
YES
INCREMENT
CHARACTER
COUNT
NO
CALCULATE
BUFFER ADDRESS
OF ANSWER
PK00
STORE
CHARACTER
UP00
PICK UP
CHARACTER
PK01
STORE
CHARACTER
TA
87

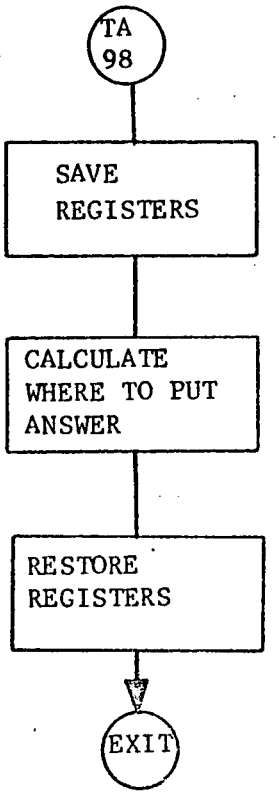

TA
87
ALL
OF ANSWER
STORED?
YES
NO
UP01
GET NEXT
CHARACTER
IS
IT SENTINEL
YES
NO
EXIT
TA
87

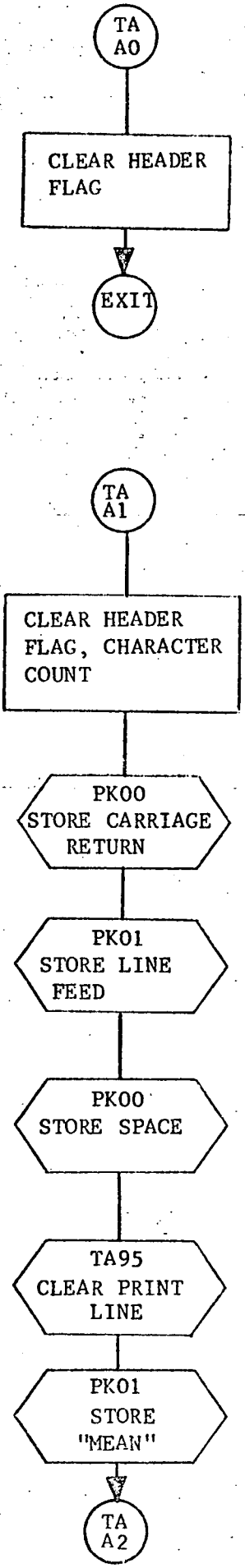

TA
90
PK00
STORE
CARRIAGE
RETURN
PK01
STORE LINE
FEED
UP00
GET 1ST
CHARACTER OF
SS NO.
PK01
STORE IT
UP01
GET NEXT
CHARACTER
PK01
STORE IT
FINISHED?
NO
YES
TA
92

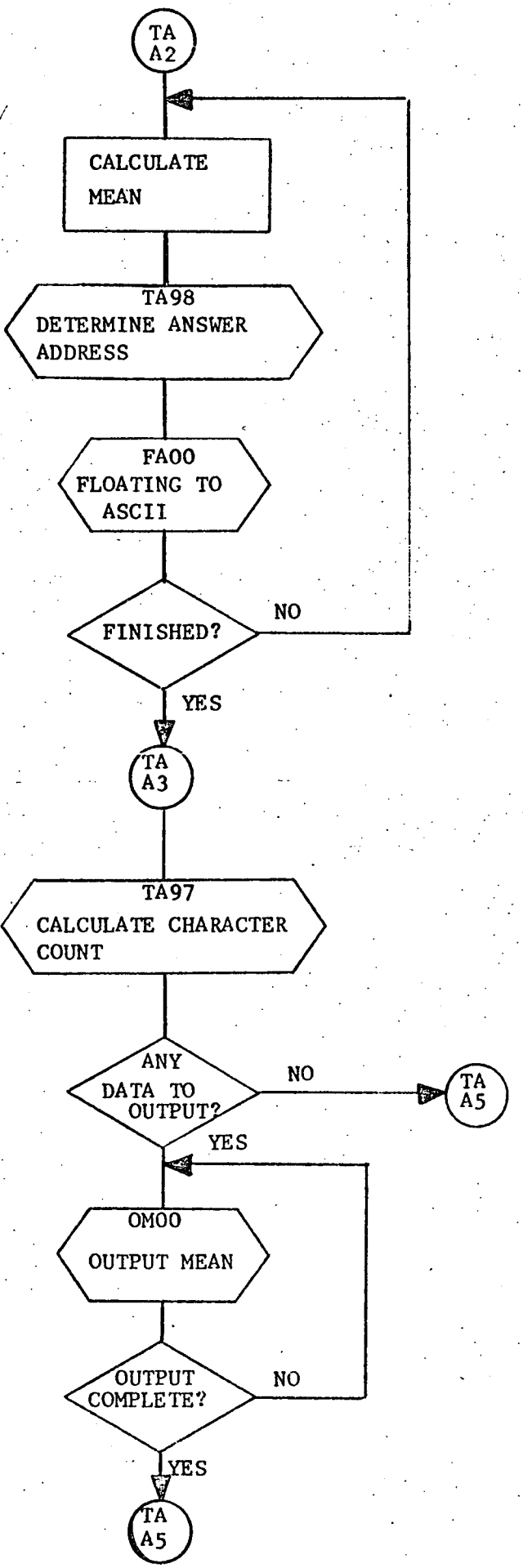

TA
92
TA95
SPACE BETWEEN
SS NO. AND
DATE
PK01
STORE DAY
CD00
CONVERT AND
STORE MONTH
PK01
STORE
YEAR
UPDATE
CHARACTER
COUNT
EXIT

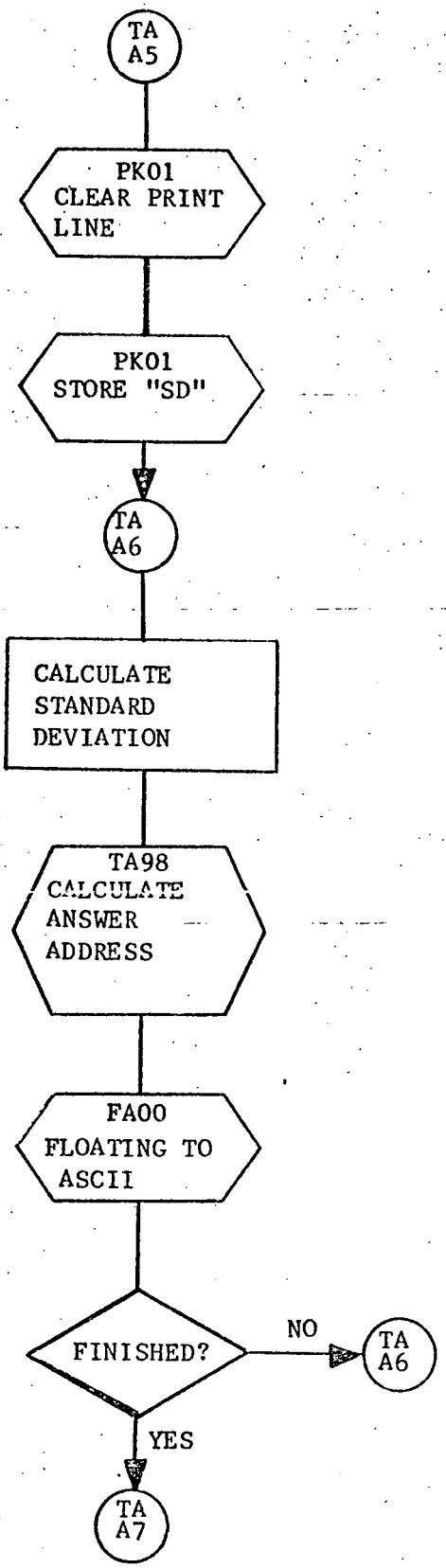

TA
96
CLEAR LOCATION
IN TABLE
FINISHED?
NO
INCREMENT
INDEX
YES
EXIT

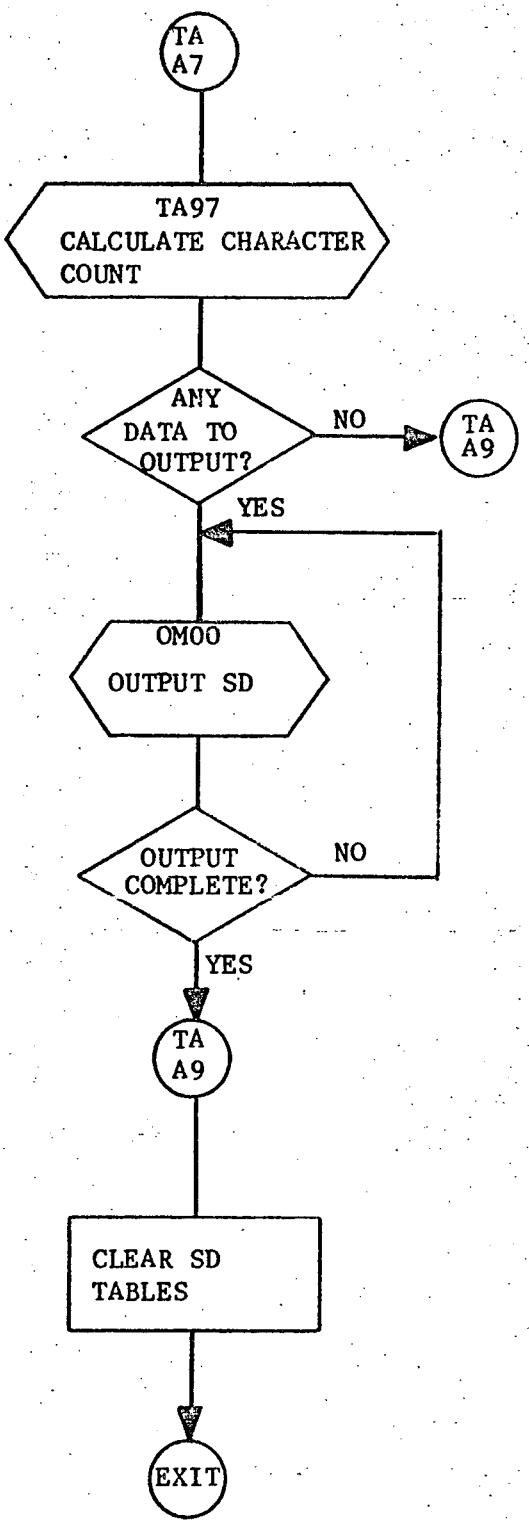

TA
97
ANY
HEADING
OUTPUT?
NO
YES
CALCULATE NUMBER
OF CHARACTERS
TO OUTPUT
INCREMENT
OUTPUT
CHARACTER COUNT
EXIT


TA
98
SAVE
REGISTERS
CALCULATE
WHERE TO PUT
ANSWER
RESTORE
REGISTERS
EXIT


TA
A0
CLEAR HEADER
FLAG
EXIT
TA
A1
CLEAR HEADER
FLAG, CHARACTER
COUNT
PK00
STORE CARRIAGE
RETURN
PK01
STORE LINE
FEED
PK00
STORE SPACE
TA95
CLEAR PRINT
LINE
PK01
STORE
"MEAN"
TA
A2


TA
A2
CALCULATE
MEAN
TA98
DETERMINE ANSWER
ADDRESS
FA00
FLOATING TO
ASCII
FINISHED?
NO
YES
TA
A3
TA97
CALCULATE CHARACTER
COUNT
ANY
DATA TO
OUTPUT?
NO
TA
A5
YES
OM00
OUTPUT MEAN
OUTPUT
COMPLETE?
NO
YES
TA
A5


TA
A5
PK01
CLEAR PRINT
LINE
PK01
STORE "SD"
TA
A6
CALCULATE
STANDARD
DEVIATION
TA98
CALCULATE
ANSWER
ADDRESS
FA00
FLOATING TO
ASCII
FINISHED?
NO
TA
A6
YES
TA
A7


TA
A7
TA97
CALCULATE CHARACTER
COUNT
ANY
DATA TO
OUTPUT?
NO
TA
A9
YES
OM00
OUTPUT SD
OUTPUT
COMPLETE?
NO
YES
TA
A9
CLEAR SD
TABLES
EXIT

3.3.39 TC00 - Trace Condition

3.3.39.1 Purpose

The purpose of this routine is to trace through the tree network in the Bool Buffer and return a true status if the top of the tree is reached, thus indicating that the entire Boolean expression of the CONDITION response is true.

3.3.39.2 Technical Description

Appendices D and C explain in detail the layout of the Operand and Bool Buffers respectively. A thorough knowledge of these buffers and the purpose and function of BL00 will be very helpful in understanding the operation of TC00.

An address (link) from the Operand Buffer is passed in the calling sequence. From the point of this address TC00 begins its tracing until one of two conditions exists: (1) the null link (-1) is reached indicating the top of the tree, or (2) a Bool Buffer nodal operation is found to be false.

Tracing is done in the following manner; as each nodal operation is found to be true, the link associated with the node is picked up and the logical conclusion of the next node is tested. This test is done in the following manner: the conclusion (left or right) pointed to by the link is set true. If the nodal operator is OR, the logical conclusion of the node is true. If the nodal operator is AND, the other conclusion (left or right) is tested. If that conclusion is true, the nodal operation

3.3.39.2 Technical Description (Continued)

is true. When the logical conclusion of the node is found to be false, the subroutine returns control to the calling routine, two locations past the normal return point. The normal return point is the location immediately following the calling sequence parameter.

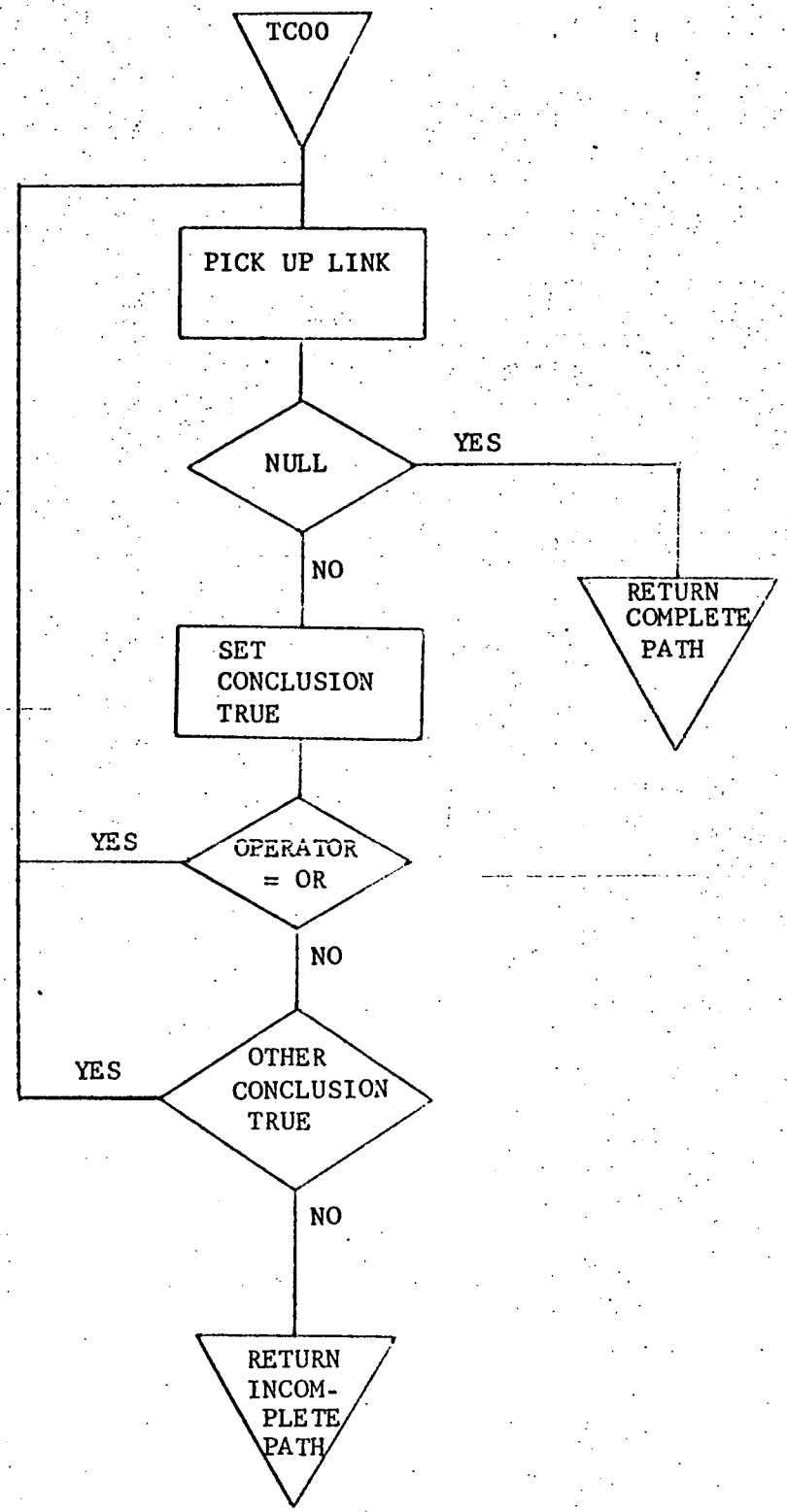
3.3.39.2.1 Calling Sequence

```
CALL   TCOO, LINK
```

PARAMETER	FUNCTION
LINK	The contents of LINK is a link address from the Operand Buffer.

REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	N/A	N/A
B	N/A	N/A
X	N/A	N/A
Overflow	N/A	N/A

3.3.39.2.2 General Flow Chart



3.3.39.3 Label Description

3.3.39.3.1 Local

None

3.3.39.3.2 Global

None

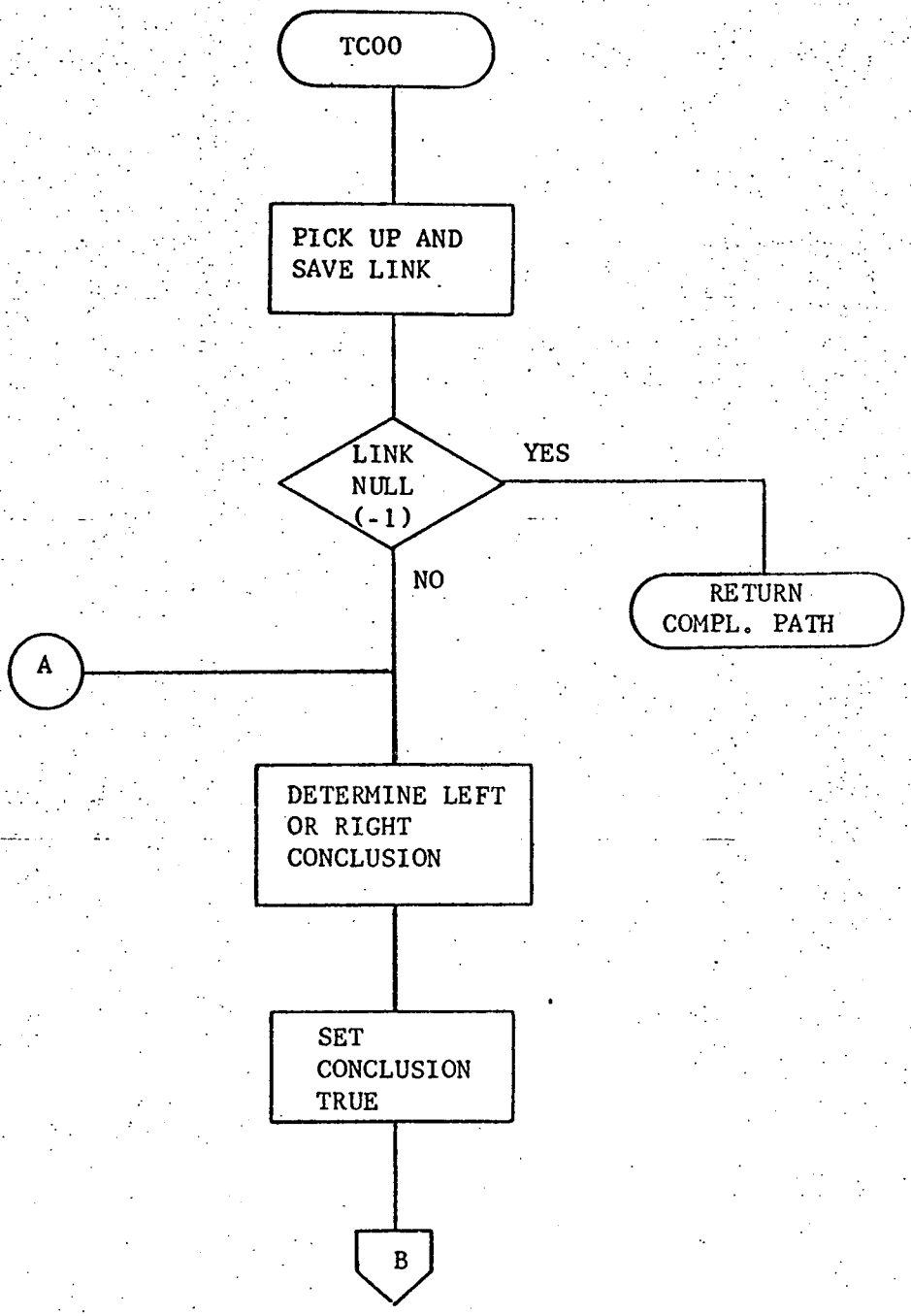
3.3.39.3.3 Entry Points

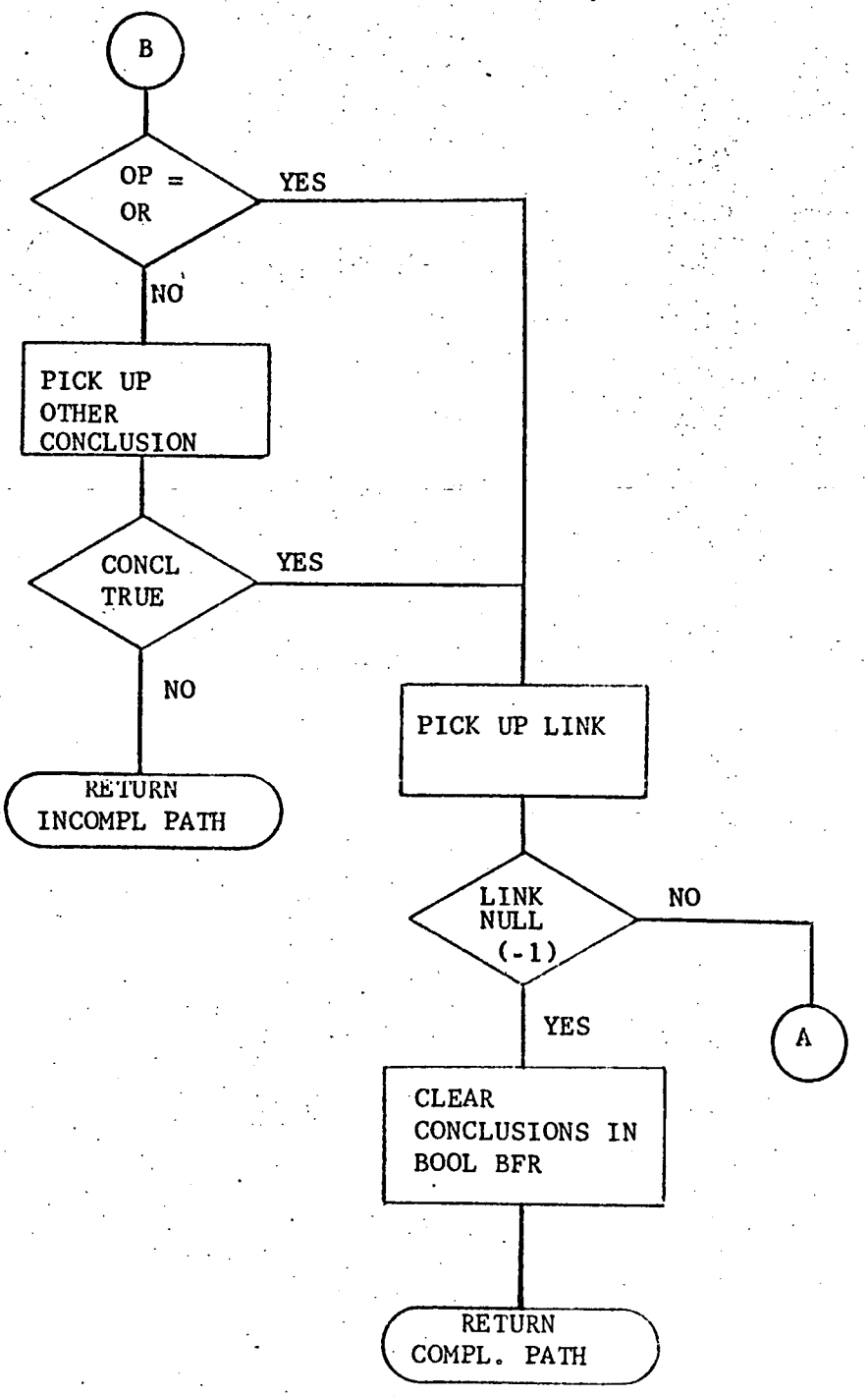
TC00

3.3.39.3.4 External References

CPBB Bool Buffer

3.3.39.4 Detailed Flow Chart




B
OP =
OR
YES
NO
PICK UP
OTHER
CONCLUSION
CONCL
TRUE
YES
NO
RETURN
INCOMPL PATH
PICK UP LINK
LINK
NULL
(-1)
NO
YES
A
CLEAR
CONCLUSIONS IN
BOOL BFR
RETURN
COMPL. PATH

3.3.40 UP00 - Unpack Character

3.3.40.1 Purpose

UP00 is a subroutine whose purpose is to return ASCII characters which have been packed two per word from a specified buffer into the A-register. The routine returns one character per call.

3.3.40.2 Technical Description

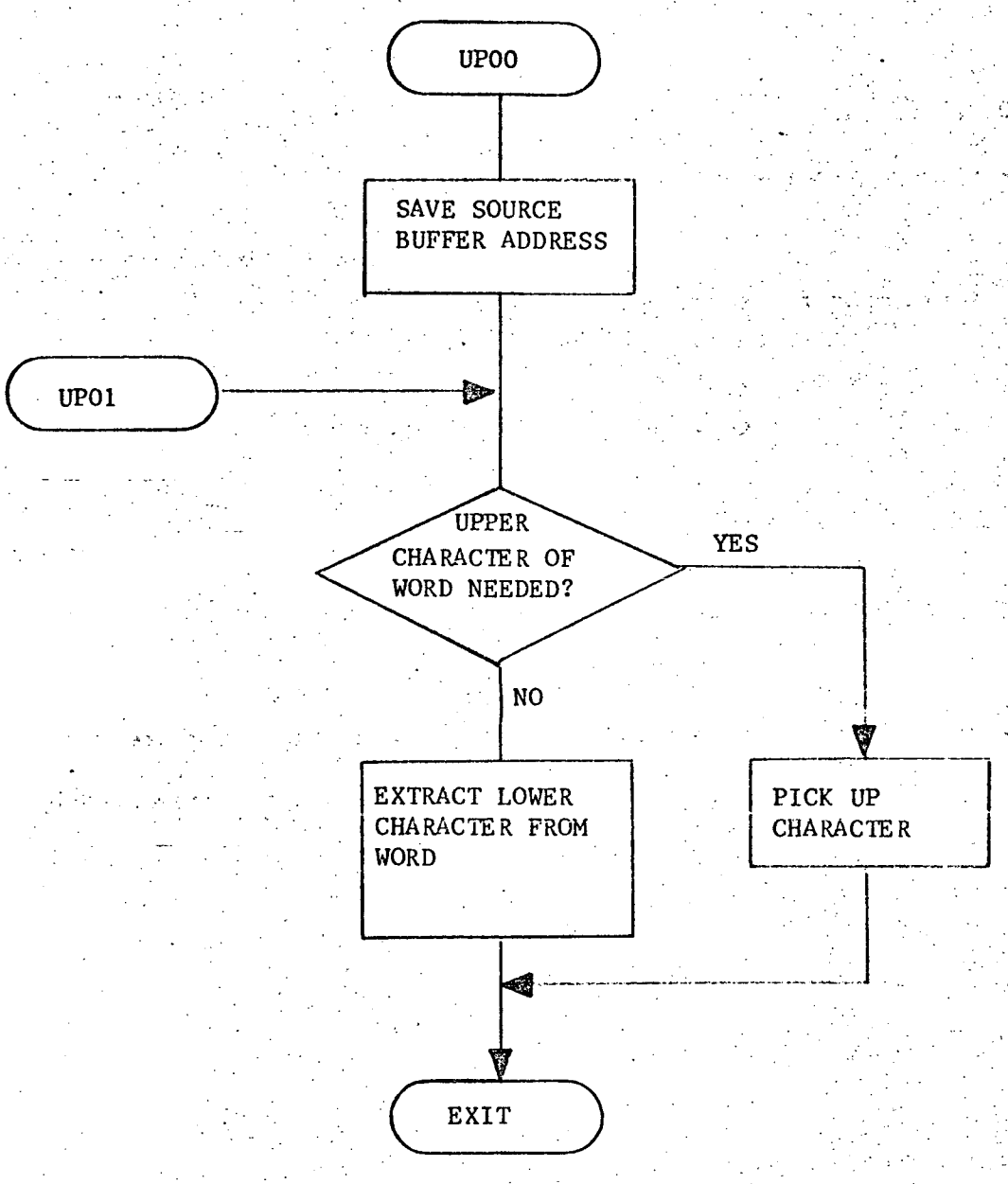
This routine has two entry points, UP00 and UP01. The first time that the routine is called control must be passed to UP00 and the starting address of the source buffer must be in the B-register. For all subsequent calls control must be passed to UP01. In both cases, the character will be returned in the A-register.

3.3.40.2.1 Calling Sequence

CALL UP00 (for initial call)

CALL UP01 (for all subsequent calls)

REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	N/A	Unpacked data character
B	Source buffer address (initial call only)	original data restored
X	N/A	N/A
Overflow	N/A	N/A


UP00
SAVE SOURCE BUFFER ADDRESS
UP01
UPPER CHARACTER OF WORD NEEDED?
YES
NO
EXTRACT LOWER CHARACTER FROM WORD
PICK UP CHARACTER
EXIT

3.3.40.3 Label Description

3.3.40.3.1 Local

UPBX - starting address of the source buffer

UPIX - index into the source buffer

UPSB - temporary storage location for the contents of the B-register

UPSW - switch which controls from which half of a data word a character is to be extracted.

UPXX - storage location initially containing the starting address of the source buffer; thereafter, its contents are incremented by the buffer index.

3.3.40.3.2 Global

None

3.3.40.3.3 Entry Points

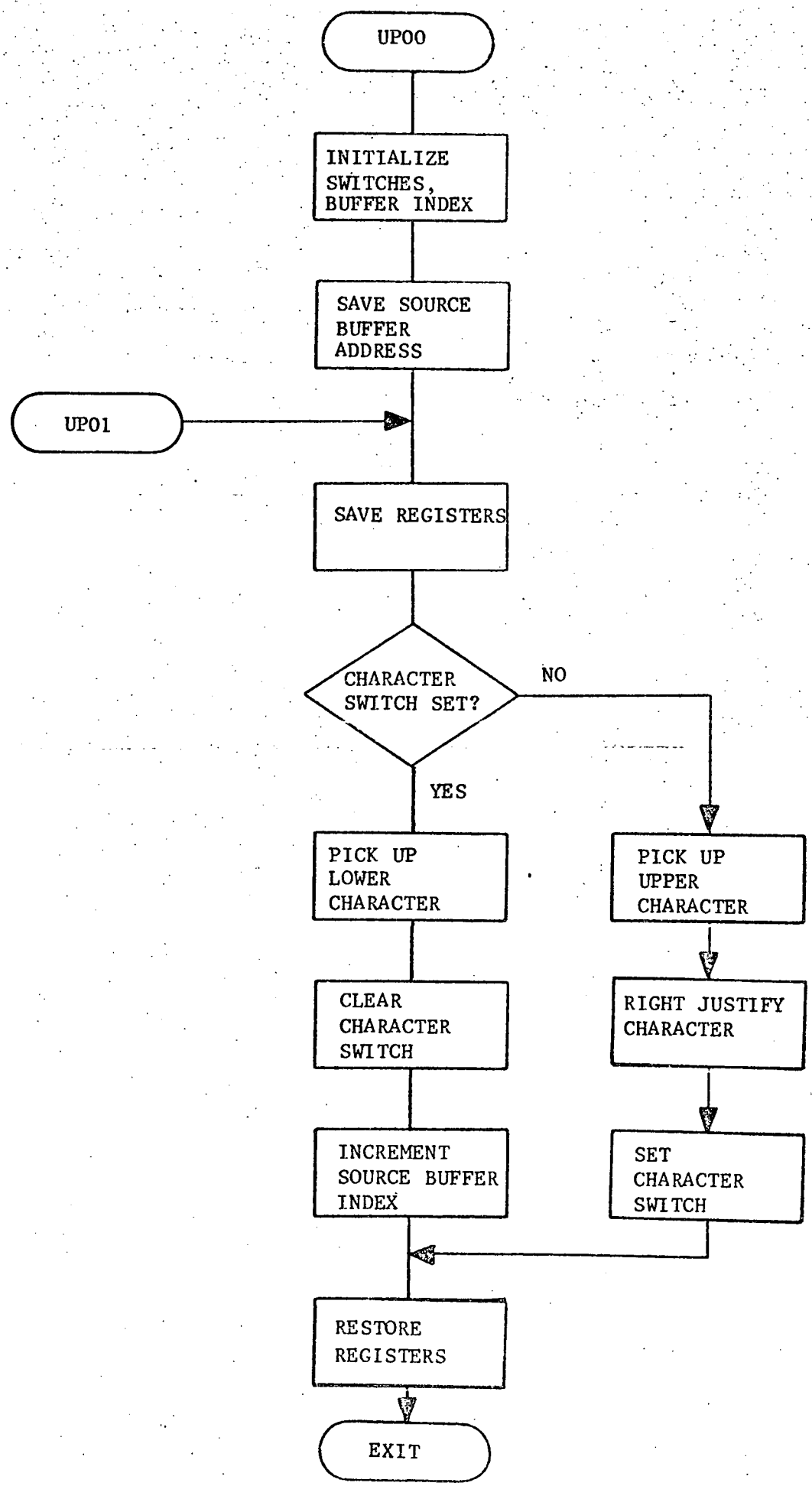
UP00 - entry point for the first call to this routine.

UP01 - entry point for all subsequent calls to this routine.

3.3.40.3.4 External References

None

3.3.40.4 Detailed Flow Chart



3.3.41 $KLF - TTY carriage return, line feed

3.3.41.1 Purpose

This routine outputs to the TTY the specified number of carriage returns and line feeds.

3.3.41.2 Technical Description

N/A

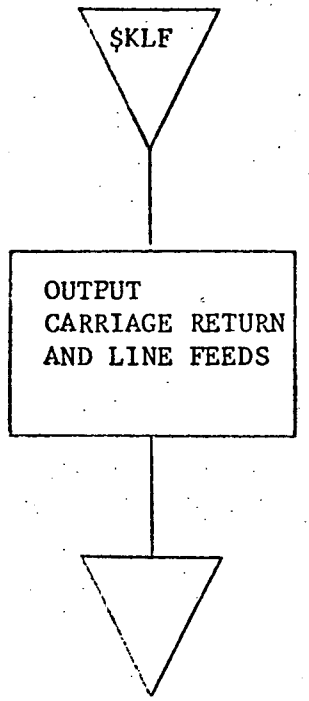
3.3.41.2.1 Calling Sequence

```
CALL  #KLF, CNT
```

PARAMETER	FUNCTION
CNT	the number of desired carriage returns and line feeds to be output to the TTY.

REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	destroyed	
B	destroyed	
X	destroyed	
Overflow	destroyed	

3.3.41.2.2 General Flow Chart



3.3.41.3.1 Local

None

3.3.41.3.2 Global

None

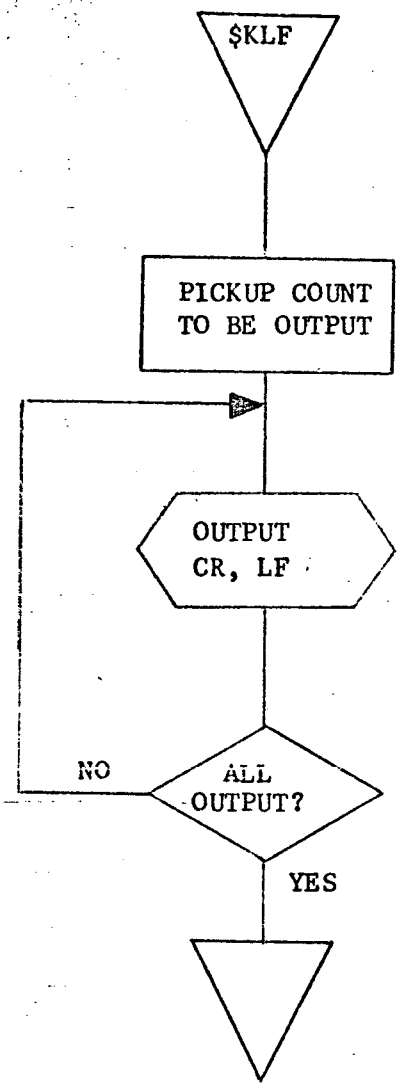
3.3.41.3.3 Entry Points

$KLF primary entry point

3.3.41.3.4 External References

OZKR output one carriage return and line feed to teletype.

3.3.41.4 Detailed Flow Chart



4.0 PROGRAM UTILIZATION

The Medical Data Tape Retrieval System (MDTRS) is a user oriented information retrieval system designed to provide on-line data retrieval capabilities. The NASA CAAD UNIVAC 1108 MEDATA system creates a master tape containing records of various medical information which is used as input to MDTRS. The user makes a retrieval request by answering pre-programmed retrieval questions. MDTRS responds to the retrieval request by searching the MEDATA master tape for the data satisfying the request criteria, formatting the selected data for output, and displaying the data on the terminal.

4.1 COMPUTER OPERATOR INSTRUCTIONS

- Load the MDTRS program from either paper tape or magnetic tape.
- Turn on the Magnetic Tape Unit.
- Mount the retrieval master tape.
- If the primary retrieval device is to be the 103A modem, it must be placed in AUTO mode.
- Begin program execution at location zero (0).
- The computer will respond with the message:

```
PLEASE INITIALIZE SYSTEM

COMPUTER CODES ARE AS FOLLOWS

DOC*A = 1

DOC*B = 2

CLINC = 3
```

4.1 COMPUTER OPERATOR INSTRUCTIONS (Continued)

DEVICE CODES ARE AS FOLLOWS

0 = NOT REQUIRED

1 = CLINC TTY#1

2 = CLINC TTY#2

3 = DOC TTY

4 = 103A MODEM

5 = CLINC CRT 73

6 = CLINC CRT 74

7 = DOC CRT 71

8 = DOC CRT 74 (REMOTE)

9 = CLINC LINE PRINTER

WHAT COMPUTER IS THIS (MUST ANSWER 1, 2, OR 3)

The operator must input the proper computer code at this time.

- The computer will then respond with the message:

PRIMARY RETRIEVAL DEVICE

(MUST ANSWER 1, 2, 3, OR 4)

The operator must input the proper device code at this time. Note that only device codes 1 thru 4 are operational at the present time.

- After the device code has been input, the computer will output the following message:

PLEASE MOUNT MASTER TAPE

TYPE UNIT NUMBER (10 OR 11)

The operator must input the tape unit number on which the retrieval master is to be placed.

4.1 COMPUTER OPERATOR INSTRUCTIONS (Continued)

- If the user requests the COPY option, the computer will output the message "MOUNT OUTPUT TAPE ON UNIT XX". The operator must mount a scratch tape on the magnetic tape unit not reserved for the retrieval master. On program termination, the message "DISMOUNT AND LABEL TAPE UNIT XX" will be output, requiring the operator to wrapup the retrieval.

4.2 OPERATIONAL PROCEDURES

There are two processes involved in retrieving: definition (defining the specific record(s) or information of interest) and action (indicating how that information is to be retrieved or output). A series of seven questions are posed to the user. See Figure 1. The answers entered in response to these questions provide the definitions of the record(s) to be considered as well as the action to be performed on the records.

The first four questions allow the user to identify the record(s) of interest. They are the same four questions or headings which comprise the identification portion of all MEDATA records in the computer, namely SS NO, RECORD, TYPE, and DATE.

SS NO

The user may specify one social security number example (SS NO: 123-45-6709) or he may answer "ALL", in which case all social security numbers in the file would be accepted. If a social security number is specified, it must be in the form of XXX-XX-XXXX, where X is a digit. If no answer is given to this question, the "default" condition "ALL" is assumed.

RECORD

The user may specify one particular record of interest example (RECORD: SURVEY) or he may answer "ALL". The RECORD response may not exceed twenty-four characters. If no answer is given to the question, "ALL" is assumed.

TYPE

The user may specify one particular type of record example (TYPE: LABORATORY) or he may answer "ALL". The TYPE response may not exceed twenty-four characters. If no answer is given to this question, "ALL" is assumed.

DATE

The user may specify one specific date example (DATE:01JAN71), a range of dates example (DATE:01JAN70-04MAR71), or "ALL". DATE must always be answered in the form of day, month, year with a three letter alpha month. If no answer is given to this question, "ALL" is assumed.

See Figure 2 for sample lists.

CONDITION

The fifth retrieval question, CONDITION, further limits the records searched to those containing specific information so that the user may specify portions of records or items from records as selection criteria. These selection criteria may be particular heading(s) with or without data. The user indicates whether a particular character string is heading

CONDITION (Continued)

or data by utilizing the colon just as it is used in the basic file structure; characters preceding the colon are interpreted as heading and characters following the colon are understood to be data. The user may wish to specify only a heading and no dat, but if he wishes to specify a data string, it must always be preceded by a heading and colon. The data itself may be either of two types: prose or coded. Prose data is alphabetic or alphanumeric, whereas coded data is numeric data and enclosed in parenthesis.

The CONDITION question offers the user three types of capabilities: string search, ranging, and Boolean logic.

STRING SEARCH

If the user specifies data as part of his selection criteria, and that data is prose, a search is made of the data field corresponding to each matching heading in every pertinent record in the file to find the exact string of characters that the user has specified. See Figure 3.

In a string search, prose and coded data may not be mixed in the same character string. For example, PURPOSE:(71)ANNUAL must be retireved in the following way: PURPOSE:71 AND PURPOSE: ANNUAL.

Furthermore, in a string search the user may not retrieve prose numeric data (numeric data not enclosed in parentheses) unless at least one alphabetic character is included. For example, WEIGHT:160 LBS will not be retrieved if the user specifies only WEIGHT:160. He must include at least one alpha character since 160 is not coded, but is prose numeric data.

RANGING

The user has the capability to specify a range of numeric values as part of his selection criteria. Any record containing a data value which falls within the range will be retrieved if that record also meets all other specifications as well. Only coded data will be searched under the ranging selection. See Figure 4.

BOOLEAN

This feature adds another dimension to the search definition AND/OR control by offering the user the capability to link selection parameters logically together with the Boolean operators AND and OR. Several sets of headings with or without data may be linked by these terms into complex retrieval requests. AND linkage requires that both criteria be met in order to constitute a valid retrieval. The OR linkage is an inclusive OR and requires that either one or both of the criteria be met. See Figure 5. The user may specify no more than ten Boolean strings in response to the CONDITION and WHAT questions. the CONDITION question may be answered with "NONE"; indicating that there is no specific selection criteria within the body of the record(s) of interest. If the question is unanswered, "NONE" is assumed.

ACTION

The first five questions (SS NO, RECORD, TYPE, DATE and CONDITION) comprise the definition segment of the retrieval. So far, the computer has been told only which records are to be searched. The sixth question indicates the action to be taken, i.e., how the computer is to output the selected information.

ACTION (Continued)

Valid actions are LIST, COUNT, COPY, TABULATE and ANALYZE. For a description of each output type see Section 4.4.1, Reports. Note that the LIST option is assumed if the user leaves this question unanswered.

WHAT

The seventh retrieval question, WHAT, allows the user to specify exactly which items in the record(s) are to be retireved if he does not wish to retrieve the whole record. The user may specify data (including numeric ranges) as well as headings. If the whole record is desired, WHAT is answered with "ALL or left unanswered.

SPECIAL CHARACTERS

The three characters described below are used to control the query - response interaction between the computer and the user.

* - An asterisk indicates the final character of each of the seven answers.

$ - The dollar sign character causes the current question to be output over again.

@ - The at sign character causes the current retrieval to be aborted.

EXECUPORT OPERATING INSTRUCTIONS

See Appendix H.

4.3 INPUT DESCRIPTION

MDTRS requires two types of input, namely; (1) Master tape records and (2) User responses to questions. MDTRS accepts the tape in MEDATA format and extracts any user requested information required. The user communicates his retrieval request to the computer by answering pre-programmed retrieval questions output by MDTRS.

4.4 OUTPUT DESCRIPTION

4.4.1 Reports

LIST

The LIST option reproduces upon output the specified record(s) or portions of records exactly as they were input. The format in which the data is retrieved is identical to the format of the stored records.

COPY

The COPY option takes those records selected for retrieval from the master tape and outputs them to a second magnetic tape, thus allowing the user to interrogate a subset of the master file as opposed to interrogating the larger master file.

COUNT

The COUNT option displays a count of all records which satisfy the selection criteria or a count of specific items within records. If the retrieval question "WHAT" is answered with "ALL", or left unanswered, all records which satisfy the selection criteria are counted, whereas, if "WHAT" is answered with a specific heading or heading/answer pair, that specific item is counted.

4.4.1 Reports (Continued)

TABULATE

The TABULATE option prints out the specified information in a tabular column form. The headings corresponding to the tabular columns of data are printed above their respective columns. Each horizontal line of tabular output begins with the social security number and the date associated with that row of data. The user may tabulate coded or prose data. See Figure 6.

ANALYZE

The ANALYZE option is identical to TABULATE with one exception. At the end of the tabulation a mean and standard deviation is provided for each heading. See Figure 7.

4.4.2 Tapes

If the user request the COPY option, the system creates as output a magnetic tape containing those records selected for retrieval. This tape may itself be used as a retrieval master tape for subsequent retrievals.

4.4.3 Messages

4.4.3.1 Diagnostics

Message	Explanation	Corrective Measure
ILLEGAL CODE	Operator has specified an incorrect computer code, device code, or magnetic tape unit number.	Input another code or tape unit number.

4.4.3.1 Diagnostics

Message	Explanation	Corrective Measure
INVALID SS NO	User has requested an invalid Social Security number; possibly an incorrect format or an alpha character in the number.	Input another Social Security number.
INVALID RECORD	User has requested a Record Name which exceeds twenty-four characters.	Input another Record name.
INVALID TYPE	User has requested a record Type name which exceeds twenty-four characters.	Input another Type name.
INVALID DATE	User has requested an invalid Date, possibly due to an alpha character in the day or year or an invalid format.	Input another Date.
INVALID CONDITION	User has requested an invalid Condition; possibly a format.	Input another Condition.

4.4.3.1 Diagnostics (Continued)

Message	Explanation	Corrective Measure
INVALID ACTION	User has requested something other than a valid Action (LIST, COPY, TABULATE, ANALYZE or COUNT).	Input another Action.
INVALID WHAT	User has requested an invalid What condition.	Input another What.
CANNOT ANALYZE	User has requested the Analyze action for prose data.	Request another Action or different What parameters.
ILLEGAL PARENTHESIS	A parenthesis has occurred in an illegal position in the answer or number of right parentheses unequal to number of left parentheses.	Make correction and input another response to the CONDITION question.

4.4.3.1 Diagnostics (Continued)

Message	Explanation	Corrective Measure
RECORD BAD-SKIPPED	There is some illegal data on the record being processed. The tape is advanced to the next record and the bad record is disregarded.	None required.
TAPE ERROR RECORD SKIP	The computer is unable to read a master tape record. The tape is advanced to the next record and the bad record disregarded.	None Required.
NO ANSWER WITH COLON	A WHAT or CONDITION heading followed by a colon has been found, but no answer following the colon has been specified.	Make correction and input another response to the question in error.
TOO MANY PARAMETERS	Too many WHAT parameters specified for the requested output device for the ANALYZE or TABULATE option.	Make correction. Only five headings are allowed for the teletype or 103A Modem.

4.4.3.2 Advisory/System Queries

Message	User Action
OUTPUT COMPLETE	Output for this request is complete. User may key in new request if desired.
PLEASE INITIALIZE SYSTEM COMPUTER CODES ARE AS FOLLOWS DOC*A = 1 DOC*B = 2 CLINC = 3	No user action. These are the corresponding code numbers of the computers on which the retrieval may take place.
DEVICE CODES ARE AS FOLLOWS 0 = NOTE REQUIRED 1 = CLINC TTY #1 2 = CLINC TTY #2 3 = DOC TTY 4 = 103A MODEM 5 = CLINC CRT 73 6 = CLINC CRT 74 7 = DOC CRT 71 8 = DOC CRT 74 (REMOTE) 9 = CLINC LINE PRINTER	No user action. These are the primary retrieval device codes.
WHAT COMPUTER IS THIS (MUST ANSWER 1, 2 OR 3)	Operator must specify on which computer the retrieval is taking place (see above for computer codes).
PRIMARY RETRIEVAL DEVICE (MUST ANSWER 1, 2, 3 OR 4)	Operator must specify on which primary I/O device the retrieval is taking place (see above for device codes). Presently only codes 1 thru 4 are operational.

4.4.3.2 Advisory/System Queries (Continued)

Message	User Action
PLEASE MOUNT MASTER TAPE TYPE UNIT NUMBER (10 OR 11)	Operator must specify the unit number of the tape drive on which the master file tape has been mounted.
SYSTEM INITIALIZED READY	No user action required. The system has been initialized properly and the user may now input his retrieval request.
MTU IS NOT READY. AFTER YOU READY MTU, PROGRAM WILL CONTINUE	Ready the magnetic tape unit on which the retrieval master tape is mounted.
PUT MAG TAPE UNIT(S) ON LINE	Due to a power failure, the magnetic tape units must be initialized to an on-line status. This is done by pressing LOAD twice and ON LINE once.
SS NO:	User must specify one Social Security number on which he wants to retrieve data or he may answer "ALL" which tells the computer to accept all Social Security numbers in the file.
RECORD:	User must specify one Record name on which he wants to retrieve data or he may answer "ALL".
TYPE:	User must specify one record TYPE on which he wants to retrieve data or he may answer "ALL".

4.4.3.2 Advisory/System Queries (Continued)

Message	User Action
DATE:	User must specify one date, a range of dates, or "ALL" dates on which he wants to retrieve data.
CONDITION:	User must specify the condition parameter(s) on which he wants to retrieve data.
ACTION:	User must specify the action (COPY, COUNT, LIST, TABULATE, or ANALYZE) he wants taken on the retrieved data.
WHAT:	User must specify upon what parameter(s) he wants the above action taken.
RETIREVAL WORKING	No user response necessary. The retrieval is in progress.
RETRIEVAL ABORTED OUTPUT TERMINATED	No user action required. This message occurs when the user has voluntarily aborted the retrieval currently in progress by pressing the @ key.
POWER FAILURE. PLEASE RESTART REQUEST ******	Power failure has occurred. User must re-enter the retrieval request.

4.4.3.2 Advisory/System Queries (Continued)

Message	User Action
CRT NOT READY	No user action required. The program will continue ignoring the last I/O request.
PARITY ERROR	No user action required. The program will continue, ignoring the last I/O request.
MODEM DISCONNECTED	No user action required. The program will continue, ignoring the last I/O request.

4.5 RESTRICTIONS

- Due to space limitations, a maximum of five headings for the teletype are allowed as WHAT answer responses when the TABULATE or ANALYZE actions are requested.

- The user may not specify a range or a serise of Social Security numbers.

- The user may specify only one type of data per heading. In a string search, prose and coded data may not be mixed in the same character string. For example,

  PURPOSE:(71)ANNUAL must be retrieved in the following way:

  PURPOSE:71 AND PURPOSE:ANNUAL.

Function	Question	Answer
	1. SS NO	= WHO?
Search	2. RECORD	= WHAT group of records?
Criteria	3. TYPE	= WHAT subset of that group of records
	4. DATE	= WHEN?
	5. CONDITION	= WHAT limitations narrow that subset?
Type of retrieval	6. ACTION	= HOW are these items to be output?
Retrieval parameters	7. WHAT	= WHAT specific items are to be output?

FIGURE 4-1 - SEVEN RETRIEVAL QUESTIONS

SS NO: 123-45-6789

RECORD: SURVEY

TYPE: LABORATORY

DATE: 01FEB69

SS NO: ALL

RECORD: ALL

TYPE: FAMILY HISTORY

DATE: 01JAN70 - 01MAR70

SS NO: 234-56-7891

RECORD: ALL

TYPE: PE

DATE: ALL

SS NO: 345-67-8912

RECORD: SURVEY

TYPE: ALL

DATE: 30MAR70

FIGURE 4-2 - SAMPLE IDENTIFICATION LISTS

SAMPLE RETRIEVAL REQUEST

SS NO	111-11-1111*
RECORD	REPORT*
TYPE	EKG*
DATE	01JAN69*
CONDITION	PURPOSE:APOLLO 13*
ACTION	LIST*
WHAT	ALL*

SAMPLE RETRIEVAL OUTPUT

111-11-1111	REPORT	EKG	01JAN69
NAME:		DOE, JOHN	
PURPOSE:		APOLLO 13 F-5	
MEASUREMENTS			
RHYTHM:		(xxx)	
RATE:		(xxx)	
INTERVALS			
P-R:		(xxx)	
QRS:		(xxx)	
QT:		(xxx)	
AXIS:		(xxx)	
DESCRIPTIONS			
LIMB LEADS		xxx	
PRECORDIAL LEADS:		xxx	
INTERPRETATION:		xxx	
COMMENTS:		xxx	
EXAMINER:		xxx	

FIGURE 4-3 - CHARACTER STRING SEARCH

SS NO	ALL*
RECORD	SURVEY*
TYPE	MEASUREMENT*
DATE	ALL*
CONDITIONS	WEIGHT:150-200*
ACTION	LIST*
WHAT	ALL*

FIGURE 4-4 - SAMPLE RANGING

SS NO	ALL*
RECORD	REPORT*
TYPE	LABORATORY*
DATE	ALL*
CONDITIONS	EXAM:HEMATOLOGY AND PURPOSE:APOLLO 13
	AND WBC:3800-4400 AND
	(HB:15-16 OR HCT:0-45)*
ACTION	LIST*
WHAT	ALL*

FIGURE 4-5 - SAMPLE BOOLEAN

SAMPLE RETRIEVAL REQUEST

SS NO	ALL*
RECORD	SURVEY*
TYPE	MEASUREMENT*
DATE	15JAN69-15MAR69*
CONDITIONS	NONE*
ACTION	TABULATE*
WHAT	HEIGHT AND WEIGHT AND BUILD AND TEMP:99-100

SAMPLE RETRIEVAL OUTPUT

		HEIGHT	WEIGHT	BUILD	TEMP
123-45-6789	23JAN69	70.50	175.00	MEDIUM	99
456-78-9123	3FEB69	68.75	167.00	MEDIUM	99
678-23-4567	15MAR69	68.00	152.00	SMALL	100

FIGURE 4-6 - SAMPLE TABULATE

SAMPLE RETRIEVAL REQUEST

SS NO	111-11-1111*
RECORD	SURVEY*
TYPE	MEASUREMENT*
DATE	ALL*
CONDITIONS	WEIGHT*
ACTION	ANALYZE*
WHAT	ALL*

SAMPLE RETIREVAL OUTPUT

		WEIGHT
111-11-1111	01JAN68	180
111-11-1111	01FEB68	181
111-11-1111	01MAR68	183
111-11-1111	01APR68	180
111-11-1111	01SEP68	185
	MEAN	181.8
	SD	2.46

FIGURE 4-7 - SAMPLE ANALYZE

APPENDIX A

TAPE DESCRIPTION

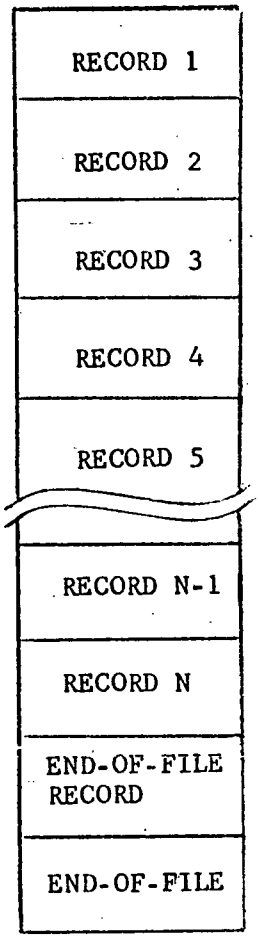


FIGURE A-1 MASTER FILE STRUCTURE

MASTER FILE

The Master File is composed of N records of variable length, not to exceed 2880 words. At the end of the data a special end of file record is written to avoid any incompatibility between drives that would prevent the hardware end of file from being recognized.

MASTER FILE INFORMATION

The Master File information is made up of three parts: Heading, Answer, and Level Code. The Heading is that background data that asks a question (e.g., Blood Pressure, Temperature, etc.). In some cases, however, it merely identifies the category of the Headings (or questions) to follow (e.g., Cardiovascular, Musculoskeletal, etc.). The Answer is the response made to the question. This response may be narrative or numeric (coded) data. The Level Code defines the relationship among all the Headings and Answers on a record. The use of Level Codes breaks down a particular record into paragraphs of related information.

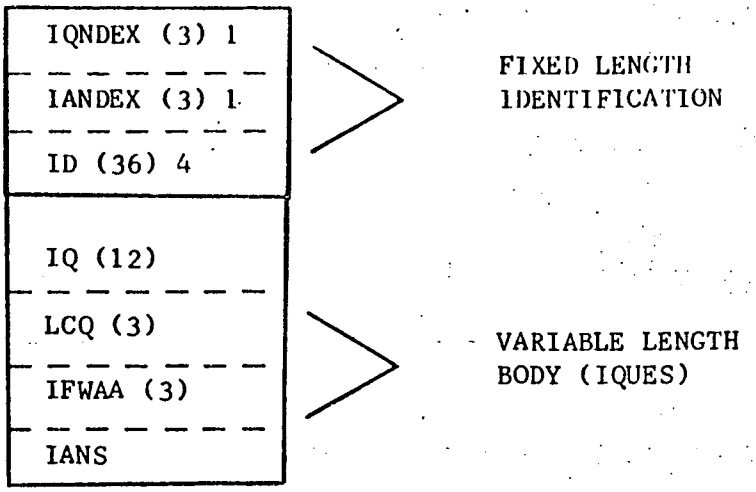


FIGURE A-2 RECORD STRUCTURE

DATA RECORD

A data record consists of a Fixed Length Identification and Variable Length Body. FIGURE A-2 illustrates the organization of a record. The segments are identified by mnemonics which were used in addressing these same segments in the original MEDATA programs. Six of the seven segments of a record are composed of word blocks and their size in words is specified in the parenthesis following each mnemonic. The number following the parenthesis is the number of blocks in each segment of the Identification. (The blocks of the segment IANS are variable length.) The number of blocks in each segment of the Body is dependent upon the contents of the IQNDEX segment.

IQNDEX

This segment of the Identification is a number that specifies the total number of Headings that are found in the record. All records have at least eight Headings, so IQNDEX will be greater than eight.

IANDEX

This segment of the Identification specifies the length of the segment IANS.

ID

The ID segment is made up of four 36-word blocks. These blocks contain the Answers to the first four Headings of a record. These Headings are: SS NO, RECORD, TYPE, and DATE. The Answers begin in the fourth word of the block.

IQ

This segment of the Body contains all the Headings of the record, one in each twelve word block. The number of blocks is equel to the value in the IQNDEX segment.

LCQ

This segment of the Body contains the Level Codes which are found in the third word of each three word block. The number of blocks is equal to the value in the IQNDEX segment.

IFWAA

This segment of the Body contains pointers relative to the beginning of the IANS segment. These pointers address the beginning of each respective Answer to the Heading in IQ. The number of three word blocks is equal to the value in the IQNDEX segment.

IANS

This segment of the Body is made up of variable length blocks which contain the Answers associated with the Headings in IQ. There are three types of data allowed in IANS and they have priorities:

(1) date data

(2) numeric data

(3) narrative data

The date is a fixed length of seven characters and is preceded by an equal sign. The narrative data is variable in length and is always preceded by a colon. The numeric data is found between the two, and is also variable in length.

END-OF-FILE-RECORD

The end-of-file record has an IQNDEX value of one. This is the only record on the entire record with such a value.

APPENDIX B

REQUEST TABLE

The Request Table is a seven word buffer that correlates each Request question either to some location in memory where the user response is saved, or to a flag which represents certain standard responses. The seven Request questions are:

SS NO

RECORD

TYPE

DATE

CONDITION

ACTION

WHAT

Responses are saved in the Request Buffer, and, for the first four questions, the Request Table relates directly to this buffer through pointers. These pointers are indices into the buffer, and they locate the beginning of each saved response.

The fifth and seventh questions relate indirectly to the Request Buffer in that they point to a location in the Operand Buffer whose contents addresses the saved response in the Request Buffer.

STANDARD RESPONSES

All the responses to the sixth question and one response to the other questions are called standard responses. In the case of these responses

the Request Table location contains a flag rather than a pointer.

The standard responses are:

SS NO: ALL*

RECORD: ALL*

TYPE: ALL*

DATE: ALL*

CONDITION: NONE*

ACTION: LIST, COPY, COUNT, TABULATE, OR ANALYZE*

WHAT: ALL*

The flags for each of these responses are:

ALL = 0

NONE = 0

LIST = 0

COPY = 1

COUNT = 2

TABULATE = 3

ANALYZE = 4

DEFAULT RESPONSES

If no response is given to a question, the standard response whose flag is zero is assumed as follows:

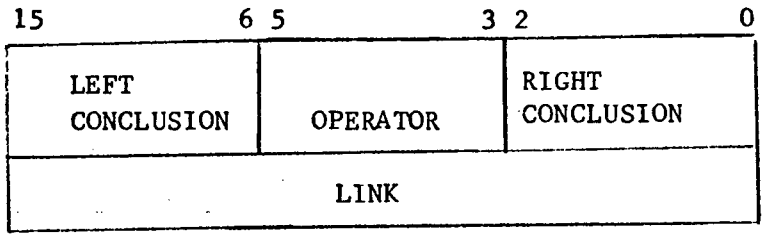
SS NO: ALL*
RECORD: ALL*
TYPE: ALL*
DATE: ALL*
CONDITION: NONE*
ACTION: LIST*
WHAT: ALL*

See FIGURES 3-1, 3-2, and 3-3 for examples of the Request Table.

APPENDIX C

BOOL BUFFER

The Bool Buffer consists of several nodes. Each node is made up of four parts: left conclusion, right conclusion, operator, and link.



The node is two memory locations which represent a simple Boolean expression, which is an experession in Boolean algebra that consists of one operator and two operands (however, the operand may itself be a simple expression). The logical conclusion of any node is the Boolean result of the nodal operation of that node.

The link, the second word in a node (node 1), is a pointer to another node (node 2). If the link of node 1 addresses the first word or second word of node 2, then node 1 represents the left operand or right operand, respectively, of node 2. Thus, if the logical conclusion of node 1 is found to be true, and if the link of node 1 addresses the second word of node 2, then the right conclusion of node 2 must be set true. FIGURE 3-3 is a diagram of the relation of the Bool Buffer to a Retrieval Request. Section 3.3.1 gives a thorough description of how the links are created in the Bool Buffer, and Section 3.3.39 describes the use of this buffer in evaluating a Boolean expression.

APPENDIX D

OPERAND BUFFER

The Operand Buffer is a buffer, forty words in length, that is utilized in two-word sets. Each set contains two pointers; the first pointer addresses the Request Buffer and the second links to the Bool Buffer.

The responses to the Retrieval Request questions CONDITION and WHAT may consist of a Boolean expression, where the operand of the expression is saved in the Request Buffer, and a coded version of the operator is saved in the Bool Buffer. To maintain the original form of the expression, the Operand Buffer is used to link each operand to an operator.

See FIGURES 3-2 and 3-3 for a diagram of the relation of the sets in the Operand Buffer

POINTER TO OPERAND IN REQUEST BUFFER
LINK TO OPERATOR IN BOOL BUFFER

APPENDIX E

REQUEST BUFFER

The Request Buffer (CPRB) is a 480 word buffer into which all non-standard responses are saved (see Appendix B for explanation of standard responses). The data is packed two ASCII characters per word, with all blanks removed.

SS NO

The response to the first question in the Retrieval Request (SS NO) is saved in the first six locations of the Request Buffer, unless there is no response or the standard response ALL is found. This response is not terminated by the terminal character (177_8) as is the case with other responses.

RECORD and TYPE

If a non-standard response is made to the second and/or third questions of the Retrieval Request, it/they will be saved beginning at the next available new word boundary. The last character in both cases will be the terminal character Ⓣ (177_8).

DATE

The non-standard response to the fourth question of the Retrieval Request will be one of two forms: a single data or two dates representing a range of dates. If a single date is the response, the data is stored beginning at the next available word boundary, and a terminal character

DATE (Continued

is stored at the end. If two dates are input, both begin at the next available word boundary, and end with a terminal character.

CONDITION and WHAT

Non-standard responses to the fifth and seventh questions of the Retrieval Request may be one of four forms:

(1) Heading alone

(2) Heading plus alpha Answer

(3) Heading plus numeric Answer

(4) Heading plus a range of numeric Answer.

In each case the Heading is stored beginning at the next available word boundary, and terminated with a terminal character. For the second and third forms the Answer is also begun on a new word boundary and ended with a terminal character. For the fourth form each Answer, representing the upper and lower limit of the range, is stored in the same manner as the second and third forms.

ACTION

All responses to the sixth question of the Retrieval Request are standard responses, and since only non-standard responses are stored in the Request Buffer, the response to this question is not saved.

See FIGURES 3-1, 3-2, and 33 for diagrams of the Request Buffer.

APPENDIX F

CONDITION TABLE

The Condition Table is broken down into one, two, or three word sets. The first word of each set is a flag and is associated with one operand in the response to the fifth question of the Retrieval Request, CONDITION. This response may be made up of several operands and they may be one of four different forms:

(1) Heading alone

(2) Heading plus alpha Answer

(3) Heading plus numeric Answer

(4) Heading plus a range of numeric Answer.

HEADING ALONE

If the operand is a Heading alone, the Condition Table will supply one word whose contents is zero.

HEADING PLUS ALPHA ANSWER

The set associated with this form of operand is two words. The first word is a flag of one; the second word is a pointer to the beginning of the Answer in the Request Buffer.

HEADING PLUS NUMERIC ANSWER

The set associated with this form of operand is two words. The first word is a flag of two; the second word is a pointer to the beginning of the Answer in the Request Buffer.

HEADING PLUS A RANGE OF NUMERIC ANSWER

The set associated with this form of operand is three words. The first word is a flag of three; the second and third words are pointers to the lower limit and upper limit respectively of the Answer stored in the Request Buffer

SUMMARY

FORM	FLAG	NO. OF WORDS IN SET
Heading alone	0	1
Heading plus alpha Answer	1	2
Heading plus numeric Answer	2	2
Heading plus range of numeric Answer	3	3

See FIGURE 3-3 for a diagram of the Condition Table.

APPENDIX G

WHAT TABLE

The format of the What Table is the same as the Condition Table (see Appendix F).

See FIGURES 3-3 for a diagram of the What Table.

APPENDIX H

READYING THE EXECUPORT 300 RETRIEVAL SYSTEM

1. If the computer has not already been readied, call 713-483-4796 or Philco at 713-488-1270, X-564 and have the Retrieval System initialized for remote terminal use.

2. Lift the lid of the Execuport 300 and position the five switches at the front as follows:

MODE	Line
DUPLEX	Full
CHAR/SEC	30
PARITY	Odd
QSL	Upper

3. Turn on Execuport 300.

4. From any telephone dial 713-483-6260 and wait for a continuous high-pitched tone. This should come after one ring.

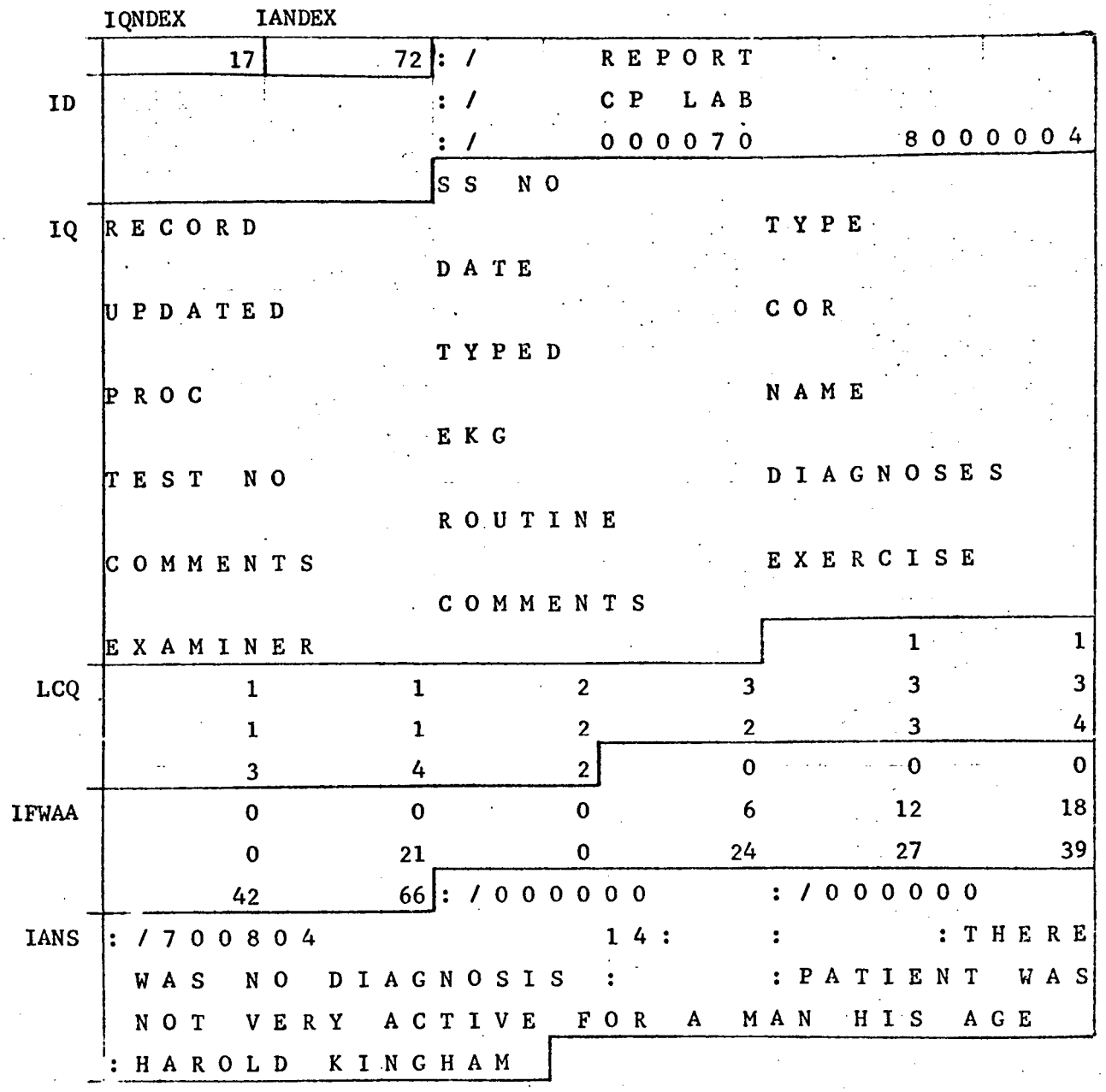
5. Insert the telephone receiver, with the cord toward the front, into the receptacle on the side of the Execuport 300. Make certain that the receiver is secure.

6. Wait for the "Ready" light, on the left front panel, above the keyboard of the Execuport 300 to come on.

7. Type in "@". This will begin the output of the seven retrieval request-questions.

APPENDIX I

SAMPLE INPUT



TAPE INPUT

SAMPLE INPUT (Continued)

SAMPLE REQUESTS

```
SS NO: *
RECORD: REPORT*
TYPE: LABORATORY*
DATE: *
CONDITION: EXAM:SERUM*
ACTION: *
WHAT: *


SS NO: *
RECORD: *
TYPE: *
DATE: *
CONDITION: *
ACTION: COUNT*
WHAT: *


SS NO:*
RECORD: REPORT*
TYPE: LABORATORY*
DATE: *
CONDITION: EXAM:SERUM*
ACTION: TABU*
WHAT: GLU AND SGOT AND A1 AND A2 AND B*


SS NO: *
RECORD: REPORT*
TYPE: LABORATORY*
DATE: *
CONDITION: EXAM:SERUM AND GLU:70-80*
ACTION: ANALYZE*
WHAT: GLU AND SGOT AND A1 AND A2 AND B*


SS NO: 111-22-3333*
RECORD: REPORT*
TYPE: LABORATORY*
DATE: 01JUN72-09SEP74*
CONDITION: EXAM:UA RANDOM OR (EXAM:SERUM AND GLU :70-80)*
ACTION: LIST*
WHAT: EXAM AND NAME AND GLU*
```

SAMPLE INPUT (Continued)

DEFAULT

```
SS NO:*
RECORD:*
TYPE:*
DATE:*
CONDITION:*
ACTION:*
WHAT:*
```

ID LIST

```
SS NO:*
RECORD:*
TYPE:*
DATE:*
CONDITION:*
ACTION:*
WHAT: ID ONLY*
```

APPENDIX J

SAMPLE OUTPUT

LIST

```
111-22-3456  REPORT LABORATORY 10JUN71

UPDATED
 COR
 TYPED:                 000000
 PROC:                  710706
NAME:
PERMANENT BASE:         KSC
PURPOSE:APOLLO 15 SURVEILLANCE PC
  SEX:M
  BIRTHYEAR:            (TF)
CATEGORY:COMPLETE
 EXAM:SERUM
  SEROLOGY
   CRP:                 POS
  HEMATOLOGY
   HCT:                 (36)PCT
   WBC:                 (10300)CU MM
    DIFF
     NEUT:              (7931)CU MM
     LYMPH:             (2163)CU MM
     MONO:              (0)CU MM
     EO:                (206)CU MM
     BASO:              (0)CU MM
     BANDS:             (0)CU MM
   MORPH:MOD. HYPOCHROMIA
  CHEMISTRY
   GLU:                 (74)MG PCT
   SGOT:                (13)MU/ML
   BUN:                 (21)MG PCT
   URIC ACID:           (5.9)MG PCT
   ALK PHOS:            (28)IU
   CREATININE:          (1.8)MG PCT
   LDH:                 (253)MU/ML
  ELECTROPHORESIS
   PROTEIN:             (7.1)GM PCT
    ALBUMIN:            (4.0)GM PC
    GLOBULIN
     A1:                (0.3)GM PCT
     A2:                (0.9)GM PCT
     B:                 (1.0)GM PCT
     G:                 (0.8)GM PCT
  OTHER:
  COMMENTS:
```

COUNT

COUNT IS 0362

TABULATE

		GLU	SPOT	A1	A2	B
111-11-1111	10JUN71	74	13	.3	.9	1.0
222-22-222	07JUL71	108	15	.2	.5	.7
333-33-3333	11JUN71	106	12	.1	.5	.8
444-44-4444	08JUN71	100	15	.2	.6	.9
555-55-5555	07JUN71	92	12	.1	.5	.8
666-66-6666	22JUN71	132	18	.3	.7	.8
777-77-7777	22JUN71	132	18	.3	.7	.8

ANALYZE

		GLU	SGOT	A1	A2	B
111-11-1111	10JUN71	74	13	.3	.9	1.0
222-22-2222	09JUL71	94	20	.2	.6	1.0
333-33-3333	16JUN71	94	10	.1	.5	1.0
444-44-4444	16JUN71	116	14	.3	.6	1.1
555-55-5555	08JUN71	98	16	.2	.8	1.0
666-66-6666	10JUN71	90	18	.2	.6	1.0
777-77-7777	10JUN71	80	15	.3	.8	1.0
	MEAN	92.28523	15.14262	.2281945	.6845840	1.014264
	SD	13.48640	3.287307	.0754685	.1461453	.037742